

CENTRAL ASIATIC EXPEDITIONS

AMERICAN MUSEUM
OF
NATURAL HISTORY

美國博物館

中亞調查記

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PRELIMINARY REPORTS VOL. II 1926-1929

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CENTRAL ASIATIC EXPEDITIONS OF THE AMERICAN MUSEUM
OF NATURAL HISTORY, UNDER THE LEADERSHIP
OF ROY CHAPMAN ANDREWS

PRELIMINARY CONTRIBUTIONS
IN
GEOLOGY, PALÆONTOLOGY,
ARCHÆOLOGY, BOTANY
AND ZOOLOGY
1926-1929

W. D. MATTHEW
WALTER GRANGER
J. T. NICHOLS
GLOVER M. ALLEN
CHARLES P. BERKEY
N. C. NELSON
WILLIAM K. GREGORY
G. G. SIMPSON

T. D. A. COCKERELL
CLIFFORD H. POPE
RALPH W. CHANEY
KARL PATTERSON SCHMIDT
ALFRED REHDER
HENRY FAIRFIELD OSBORN
F. K. MORRIS
L. ERSKINE SPOCK

Reprints of Asiatic papers appearing in the *American Museum Bulletin* and
Novitates, for the years 1926-1929

VOLUME II
Nos. 64 to 96

List of additional articles, 1926-1929,
not included in this volume

TO THE BENEFACTORS OF THE CENTRAL ASIATIC EXPEDITIONS

The Central Asiatic Expeditions of The American Museum of Natural History, under the leadership of Roy Chapman Andrews, beginning in the year 1916, constitute thirteen years of exploration and research. The results are being recorded in three series of publications, as follows:

First, popular articles by Doctor Andrews, Professor Osborn and others have appeared in ASIA Magazine and other periodicals, as fully listed in the bibliography of Volume I, dated 1918-1925, and in the present Volume II, dated 1926-1929. These popular articles contain much information concerning the narrative, routes, personnel, and adventures of the Expeditions which will be covered in more serious and substantial form in Volume I of the series *Natural History of Central Asia*, entitled "The New Conquest of Asia," now being prepared in Peking by Doctor Andrews.

Second, ninety-six preliminary papers and reports in Geology, Palæontology, Archæology, Botany and Zoology have been issued as fast as the wonderfully interesting new scientific material could be studied and compared in the American Museum. The present Volume II covers Preliminary Contributions¹ 64 to 96 of this series, first issued as *Novitates* and *Bulletins* of the American Museum and now collected in a limited edition of 100 copies. This edition of the collected Preliminary Contributions is being sent to the active centers of research and publication in various parts of the world, so as to make the Preliminary Contributions immediately and conveniently available to the scientific workers in all the numerous branches covered by the Expeditions.

Third, a series entitled *Natural History of Central Asia*, is planned to include more material and a comprehensive description of the work of the Expeditions, to embrace 12 volumes, of which Volume II, entitled "The Geology of Mongolia," covering the geological work of Messrs. Berkey and Morris to the end of the year 1923, was published in December, 1927. Of this series six additional volumes are now in active preparation, namely: Volume I by Doctor Andrews, Volume III by Messrs. Berkey, Morris and Spock, Volume IV by Doctor A. W. Grabau, Volume V by Messrs. Berkey, Roberts and Hill, and Volumes VI and VII by Professor Osborn and Curator Granger, assistant chief of the Expeditions. A prospectus of these volumes is enclosed with the present Volume II of the Preliminary Contributions.

¹These volumes are not freely distributed. They are for sale on application to the American Museum Library.

The Central Asiatic Expeditions of the American Museum of Natural History are supported by 383 individual contributors from no less than thirty-seven different States of the Union, Porto Rico, Hawaii, and nine foreign countries; an annual contribution of \$5,000 from the Field Museum; an annual contribution of \$5,000, from the Treasury of the American Museum, and in addition, the salaries of members of the American Museum Staff, namely: Messrs. Andrews, Granger, Nelson, Pope and Thomson, who have taken part in the active field work of the Expeditions. Altogether, more than \$500,000 has been expended on the Central Asiatic Expeditions since 1916. The annual cost of the Expeditions in recent years has been between \$35,000. and \$40,000. This does not include the publication of the Preliminary Contributions at the expense of the American Museum.

As President of the American Museum of Natural History, I desire to express our gratitude to the generous benefactors in all parts of our country and of foreign lands, who have helped to make these great Expeditions possible, by their faith in the results and the generosity of their contributions. Second, I desire to express the appreciation of the American Museum to the splendid corps of field workers, led by Doctor Andrews, who have coöperated to make these Expeditions so tremendously successful. Third, on behalf of the American Museum Scientific Staff, I desire to express our gratitude and appreciation of the able co-operation of scientific workers of other institutions, as well as of our own, in bringing these results so promptly to the knowledge of the scientific world, so that they are rapidly being incorporated in the general advance of the sciences of Geography, Geology, Archæology, Palæontology, Zoology and Botany.

HENRY FAIRFIELD OSBORN,
President.

THE AMERICAN MUSEUM OF NATURAL HISTORY,
February 14, 1930.

ARTICLES INCLUDED IN THIS VOLUME

- Dedication.** By Henry Fairfield Osborn.
64. **Two New Perissodactyls from the Arshanto Eocene of Mongolia.**
By W. D. Matthew and Walter Granger. *American Museum Novitates*, No. 208, February 16, 1926.
 65. **Some Chinese Fresh-Water Fishes.** By J. T. Nichols. *American Museum Novitates*, No. 214, May 7, 1926.
 66. **Rats (Genus *Rattus*) from the Asiatic Expeditions.** By Glover M. Allen. *American Museum Novitates*, No. 217, June 16, 1926.
 67. **Geology and Prehistoric Archæology of the Gobi Desert.** By Charles P. Berkey and N. C. Nelson. *American Museum Novitates*, No. 222, June 28, 1926.
 68. **Some Chinese Fresh-Water Fishes.** By J. T. Nichols. *American Museum Novitates*, No. 224, October 5, 1926.
 69. **Cretaceous Mammal Skulls from Mongolia.** By William K. Gregory and G. G. Simpson. *American Museum Novitates*, No. 225, October 8, 1926.
 70. **New Light on the Giant Fossil May-Flies of Mongolia.** By T. D. A. Cockerell. *American Museum Novitates*, No. 244, January 26, 1927.
 71. **Murid Rodents from the Asiatic Expeditions.** By Glover M. Allen. *American Museum Novitates*, No. 270, May 31, 1927.
 72. **The Fishes of Hainan.** By John T. Nichols and Clifford H. Pope. *Bull. Amer. Mus. Nat. Hist.*, LIV, Art. 2, pp. 321-394, September 12, 1927.
 73. **Hackberry Seeds from the Pleistocene Loess of Northern China.** By Ralph W. Chaney. *American Museum Novitates*, No. 283, September 13, 1927.
 74. **Lagomorphs Collected by the Asiatic Expeditions.** By Glover M. Allen. *American Museum Novitates*, No. 284, September 13, 1927.
 75. **The Reptiles of Hainan.** By Karl Patterson Schmidt. *Bull. Amer. Mus. Nat. Hist.*, LIV, Art. 3, pp. 395-465, October 6, 1927.
 76. **Notes on Chinese Reptiles.** By Karl Patterson Schmidt. *Bull. Amer. Mus. Nat. Hist.*, LIV, Art. 4, pp. 467-551, October 14, 1927.
 77. **Notes on Chinese Amphibians.** By Karl Patterson Schmidt. *Bull. Amer. Mus. Nat. Hist.*, LIV, Art. 5, pp. 553-575, October 14, 1927.

78. **Porcupines from China.** By Glover M. Allen. American Museum *Novitates*, No. 290, October 24, 1927.
79. **A New Poplar (*Populus pilosa*) from the Eastern Altai Mountains.** By Alfred Rehder. With Supplemental Notes on the Distribution and Habitat. By R. W. Chaney. American Museum *Novitates*, No. 292, November 30, 1927.
80. **New Asiatic Mammals.** By Glover M. Allen. American Museum *Novitates*, No. 317, May 19, 1928.
81. **Seven New Reptiles from Fukien Province, China.** By Clifford H. Pope. American Museum *Novitates*, No. 320, June 23, 1928.
82. **Four New Snakes and a New Lizard from South China.** By Clifford H. Pope. American Museum *Novitates*, No. 325, September 15, 1928.
83. **Chinese Fresh-Water Fishes in the American Museum of Natural History's Collections.** By J. T. Nichols. *Bull. Amer. Mus. Nat. Hist.*, LVIII, Art. 1, pp. 1-62, October 15, 1928.
84. **Further Notes on Mongolian Cretaceous Mammals.** By George Gaylord Simpson. American Museum *Novitates*, No. 329, October 26, 1928.
85. **Affinities of the Mongolian Cretaceous Insectivores.** By George Gaylord Simpson. American Museum *Novitates*, No. 330, October 30, 1928.
86. **Paleocene Multituberculates from Mongolia.** By W. D. Matthew, Walter Granger, and George Gaylord Simpson. American Museum *Novitates*, No. 331, October 30, 1928.
87. **Four New Frogs from Fukien Province, China.** By Clifford H. Pope. American Museum *Novitates*, No. 352, May 20, 1929.
88. **Embolotherium, gen. nov., of the Ulan Gochu, Mongolia.** By Henry Fairfield Osborn. American Museum *Novitates*, No. 353, May 30, 1929.
89. **Mustelids from the Asiatic Expeditions.** By Glover M. Allen. American Museum *Novitates*, No. 358, July 10, 1929.
90. **Viverrids from the Asiatic Expeditions.** By Glover M. Allen. American Museum *Novitates*, No. 359, July 15, 1929.
91. **Carnivora from the Asiatic Expeditions.** By Glover M. Allen. American Museum *Novitates*, No. 360, July 17, 1929.
92. **Notes on Reptiles from Fukien and other Chinese Provinces.** By Clifford H. Pope. *Bull. Amer. Mus. Nat. Hist.*, LVIII, Art. 8, pp. 335-487, September 7, 1929.

93. **Additions to the Fauna of the Gashato Formation of Mongolia.**
By W. D. Matthew, Walter Granger, and George Gaylord Simpson. American Museum *Novitates*, No. 376, October 7, 1929.
94. **Some Chinese Fresh-Water Fishes.** By J. T. Nichols. American Museum *Novitates*, No. 377, October 15, 1929.
95. **Additional New Formations in the Later Sediments of Mongolia.**
By Charles P. Berkey, Walter Granger, and Frederick K. Morris. American Museum *Novitates*, No. 385, November 8, 1929.
96. **Pliocene Beds of the Iren Gobi.** By L. Erskine Spock. American Museum *Novitates*, No. 394, December 26, 1929.

A LIST OF ARTICLES, ABSTRACTS AND NOTES (1926-1929) RELATING
TO THE CENTRAL ASIATIC EXPEDITIONS OF
THE AMERICAN MUSEUM OF NATURAL HISTORY
NOT INCLUDED IN THIS VOLUME

1926

ARTICLES

Roy Chapman Andrews.—"On the Trail of Ancient Man." A narrative of the field work of the Central Asiatic Expeditions. With foreword, "Asia the Mother of Continents," vii, viii, and chapter "Giant Beasts of Three Million Years Ago," by Henry Fairfield Osborn, pp. 190-207. G. P. Putnam's Sons, New York-London. The Knickerbocker Press.

Roy Chapman Andrews.—"Mongols' of Twenty Thousand Years Ago." The Third Asiatic Expedition's New Find—First Traces of Very Old Human Life in the Gobi. With ills. Note by Henry Fairfield Osborn. *Asia Magazine*, Vol. XXVI, No. 1, pp. 9-16; 70-72. January.

Roy Chapman Andrews.—"The Colossus of Mongolia." A Standing Giant Three Million Years Old, Uncovered by the Third Asiatic Expedition. With ills. *Asia Magazine*, Vol. XXVI, No. 2, pp. 113-118, February.

Roy Chapman Andrews.—"The Third Asiatic Expedition." The Crowning Discovery in the Gobi. Seven Tiny Mammal Skulls for which science will remember the Third Asiatic Expedition. With ills. *Asia Magazine*, Vol. XXVI, No. 4, pp. 287-293; 369, 370, April.

Roy Chapman Andrews.—"How American Motors put the 'Go' in Gobi." Ills. *The Literary Digest*, Vol. 88, pp. 34-44, January 9.

Roy Chapman Andrews.—"Dinosaur Egg-Hunting in the Gobi Desert": New Treasure from the 'Flaming Cliffs' and the 'Place of Muddy Water.' With ills. *The Illustrated London News*, Vol. 168, No. 4525, pp. 44-47, January 9.

Roy Chapman Andrews.—"The Dune Dwellers of Mongolia." With ills. *The Illustrated London News*, Vol. 168, No. 4526, pp. 90-92, January 16.

Roy Chapman Andrews.—"Our New Discoveries in the Gobi Desert." An official account of the Third Asiatic Expedition. With ills. *World's Work*, Vol. 51, pp. 273-288, January.

Roy Chapman Andrews.—"On the Trail of Ancient Man." With ills. *World's Work*, Vol. 51, pp. 376-395, February.

Roy Chapman Andrews.—"New Monsters of the Dead Ages." Tracing Life's Origin in Mongolia. With ill. *World's Work*, Vol. 52, pp. 181-192, June.

Charles P. Berkey and Frederick K. Morris.—"The Geological Background of Fossil Hunting in Mongolia." *Natural History*, Vol. XXVI, No. 5, pp. 527-530, September-October.

Lieut. Frederic B. Butler.—"Mapping with Third Asiatic Expedition." *The Military Engineer*, Washington, D. C., Vol. 18, No. 100, pp. 261-265. With ill., August.

Ralph W. Chaney.—"Summary of Botanical and Palæobotanical Work of 1925." Reprinted from *Carnegie Institution Year Book* No. 25, 1925-26, pp. 399-402.

R. W. Chaney.—"Bearing of Palæobotany on Habitat Conditions in Mongolia." *Natural History*, Vol. XXVI, No. 5, p. 532, September-October.

W. D. Matthew and Walter Granger.—"The Most Significant Fossil Finds of the Mongolian Expeditions." *Natural History*, Vol. XXVI, No. 5, pp. 532-534, September-October.

Ethelyn G. Nelson.—"A Houseboat on the Yangtze." *Natural History*, Vol. XXVI, No. 6, pp. 580-587, November-December.

N. C. Nelson.—"Notes on the Archæology of the Gobi." *American Anthropologist*, New Ser., Vol. 28, No. 1, pp. 305-308, January-March.

N. C. Nelson.—"The Dune Dwellers of the Gobi." *Natural History*, Vol. XXVI, No. 3, pp. 246-251, May-June.

N. C. Nelson.—"Prehistoric Man of Central Asia." *Natural History*, Vol. XXVI, No. 6, pp. 570-579, November-December.

Henry Fairfield Osborn.—"Why Central Asia?" *Natural History*, Vol. XXVI, No. 3, pp. 263-269, May-June.

Henry Fairfield Osborn and Roy Chapman Andrews.—"Palæontologic Discoveries in Mongolia," *The Encyclopædia Britannica* (13th Ed.). New Vol. II [New Form], Vols. 29-30, pp. 940-944.

Chester A. Reeds.—Frontispiece: A Dinosaur Skull in the Bedrock of Shabarakh Usu, Mongolia. This is one of the most important finds of the Central Asiatic Expeditions. *Natural History*, Vol. XXVI, No. 5, opp. p. 439, September-October.

Chester A. Reeds.—"Important Results of the Central Asiatic Expeditions." Introductory Note. *Natural History*, Vol. XXVI, No. 5, p. 527, September-October.

Chester A. Reeds.—"Scenes and Activities in Mongolia." Photographs taken by the Central Asiatic Expeditions of the American Mu-

seum of Natural History, Dr. Roy Chapman Andrews, Leader. *Natural History*, Vol. XXVI, No. 5, 8 pp., opposite p. 532, September–October.

L. B. Roberts.—"Topographic Surveys." *Natural History*, Vol. XXVI, No. 5, p. 531, September–October.

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ABSTRACTS

Roy Chapman Andrews and Charles P. Berkey.—"Some Results of the Third Season of Mongolian Exploration of the Third Asiatic Expedition of the American Museum of Natural History." [Abstract]. *Bull. Geolog. Socy. Amer.*, Vol. 37, No. 1, p. 145, March.

Ralph W. Chaney.—"Preliminary Statement regarding the Tertiary flora of Mongolia and Manchuria." [Abstract]. *Bull. Geolog. Socy. Amer.*, Vol. 37, No. 1, p. 244, March.

Henry Fairfield Osborn and William Diller Matthew.—"Summary of Discoveries in Vertebrate Palæontology in Three Seasons of Field Exploration in Mongolia (1922, 1923, and 1925)." [Abstract]. *Bull. Geolog. Soc. Amer.*, Vol. 37, No. 1, pp. 157, 158; 228, March.

Henry Fairfield Osborn.—"Methods and Results of the American Museum Expedition in the Gobi Desert, 1922, 1925." (In Abstracts of Proceedings.) *The Quarterly Journal of the Geolog. Socy. of London*, Vol. 82, pp. cx–cxiv, June 23.

Henry Fairfield Osborn.—"The Gobi Desert. Former Center of Teeming Life." *Abstracts of Proc. Geolog. Soc. London*, No. 1154, pp. 96–99, July 8.

Henry Fairfield Osborn.—"Methods and Results of the American Museum Expeditions in the Gobi Desert, 1922–25." Abstract of a lecture delivered by the author to the Geological Society of London on June 23. *Nature*, No. 2962, Vol. 118, pp. 198, 199, August 7.

Henry Fairfield Osborn.—"Discoveries in the Gobi Desert by the American Museum Expeditions." From an evening discourse delivered to the British Association at Oxford on August 9. *Nature*, No. 2968, Vol. 118, pp. 418–420, September 18.

1926

NOTES

Mr. Clifford Pope, zoologist of the Third Asiatic Expedition, who writes from Foochow, Fukien Province, China, November 16, 1925, is sending large shipment of reptiles, amphibians and other vertebrates to the Museum. Reports very successful collection season. Obtained

about 50 species of snakes. Mr. Pope found what he took to be eggs of *Pachytriton*. *Natural History*, Vol. XXVI, No. 1, pp. 105, 106, January-February.

Scientific Exploration in Fukien. Mr. Clifford Pope of the Third Asiatic Expedition of the American Museum of Natural History, visited Shanghai to secure supplies for further work in Fukien Province. Had very successful year's work, securing about 48 species of snakes, numerous lizards, 25 forms of toad and frog, many specimens of the rare salamander, *Pachytriton brevipes*, as well as other valuable material. In Kuatun district Mr. Pope found the giant viper, *Agkistrodon acutus*. *The China Journal of Science and Arts*, Vol. IV, No. 4, p. 176, April.

Palæontological and Archæological Exploration in Szechuan: Mr. Walter Granger and Mr. N. C. Nelson, palæontologist and archæologist, respectively, of the Third Asiatic Expedition of the Amer. Mus. Nat. Hist., spent several months exploring along the Upper Yangtze, between Ichang and Wan Hsien in Szechuan. Mr. and Mrs. Granger spent winter in Wan Hsien. Mr. and Mrs. Nelson explored the gorge area as far as Fu Tan. Discovered numerous evidences of a late prehistoric pre-Chinese stone culture. These collections were shipped to America from Hankow. Party on way to Peking to join Andrews, preparatory to starting for summer's work in Southwest Mongolia. *The China Journal of Science and Arts*, Vol. IV, No. 5, p. 229, May.

Letters from W. D. Matthew, dated Peking, April 14 and 20, quoted. *Natural History*, Vol. XXVI, No. 3, pp. 331, 332, May-June.

Roy Chapman Andrews writes from Peking, April 14, airplane is dropping bombs in the city; staff and two motors are at Kalgan. Battle going on, guns booming day and night. Matthew safe in Tientsin. Burden due in Peking in few days. Granger and Nelson on way up from Shanghai. Will get expedition off, but very difficult. *Natural History*, Vol. XXVI, No. 3, p. 333, May-June.

Asiatic Expedition while collecting dinosaur eggs in Gobi desert, found in Cretaceous formation parts of six skulls and a number of lower jaws of small mammals. These specimens have been worked out of matrix and studied by Dr. W. K. Gregory and Dr. G. G. Simpson. *Natural History*, Vol. XXVI, No. 3, p. 333, May-June.

Letters from Mr. Walter Granger tell of progress of the winter's work by Nelson and Granger in upper Yangtze. *Natural History*, Vol. XXVI, No. 3, pp. 331-333, May-June.

President Henry Fairfield Osborn spent two months in England. In address before Geological Society of London, discussed geological

significance made in Gobi Desert by Asiatic Expedition under leadership of Dr. Roy C. Andrews. *Natural History*, Vol. XXVI, No. 4, p. 429, July–August.

Dr. Roy Chapman Andrews cables he is able to get camel caravan safely out of Chinese war zone into Mongolia, but expedition party has not been able to take the field. Representatives of Mongolian government called upon him in Peking with formal invitation to return to Outer Mongolia. Cordial relations established; promised to give all possible aid in prosecution of work. *Natural History*, Vol. XXVI, No. 4, p. 429, July–August.

During season of 1926, shipment of 391 mammals received from the Central Asiatic Expeditions, including a series of Bharal or blue sheep (*Pseudois nahura*). *Natural History*, Vol. XXVI, No. 5, p. 546, September–October.

Dr. Roy Chapman Andrews passed through Shanghai early in September on his way back to America where he will undertake a lecture tour. Drs. Granger and Nelson have proceeded to southwestern China hoping to do palæontological and geological work during autumn and coming winter. Mr. Pope is still in Fukien, collecting reptiles and fishes. *The China Journal of Science and Arts*, Vol. V, No. 4, p. 185, October.

Failure of Third Asiatic Expedition to carry on work, owing to war conditions in Sino-Mongolian frontier. *The China Journal of Science and Arts*, Vol. V, No. 5, p. 253, November.

Mr. Walter Granger, Chief Palæontologist of Central Asiatic Expeditions, in letter to President Osborn, dated Yunnanfu, October 15, outlines plans for winter. With Mr. Granger is Mr. Nelson, Archæologist, who is searching for remains of prehistoric man. *Natural History*, Vol. XXVI, No. 6, pp. 655, 656, November–December.

Mr. Clifford Pope's explorations in Fukien. Made excellent collections, mainly of reptiles, amphibians and fishes. *The China Journal of Science and Arts*, Vol. V, No. 6, pp. 320–321, December.

1927

ARTICLES

Roy Chapman Andrews.—"Explorations in Mongolia: A Review of the Central Asiatic Expeditions of the American Museum of Natural History." The second "Asia Lecture." Read at meeting of Society, Nov. 8, 1926. *The Geographical Journal*, Vol. LXIX, No. 1, pp. 1–23 (with sketch map and 8 plates). January.

William K. Gregory.—"Mongolia The New World." Ills. Reprinted from *The Scientific Monthly*, Vol. XXIV, Part 1, pp. 5-14, January.

William K. Gregory.—"Gaps in the Mongolian Life Record." Ills. Reprinted from *The Scientific Monthly*, Vol. XXIV, Part II, pp. 169-181, February.

William K. Gregory.—"Mongolian Mammals of the 'Age of Reptiles.'" Reprinted from *The Scientific Monthly*, Vol. XXIV, pp. 225-235, March.

William K. Gregory.—"The Mongolian Age of Mammals" (Mongolia the New World. Ills. Part IV). Reprinted from *The Scientific Monthly*, Vol. XXIV, pp. 337-347, April.

William K. Gregory.—"Did Man Originate in Central Asia?" (Mongolia the New World. Ills. Part V.) Reprinted from *The Scientific Monthly*, Vol. XXIV, pp. 385-401, May.

William K. Gregory.—"Missing Links of the Gobi Desert." How a Handful of Fossils has filled a former gap in the Evolution Tree. *Scientific American*, pp. 231-232, April.

A. S. Hitchcock.—"Psammodachloa mongolica, a new grass from Mongolia." Collected by R. W. Chaney on Third Asiatic Expedition of Amer. Mus. Nat. Hist. *Journ. Washn. Acad. Sci.*, Vol. 17, No. 6, p. 140, March 19.

N. C. Nelson.—"Archæological Research in North China." A Review. *American Anthropologist*, New Ser., Vol. 29, No. 2, pp. 177-201, April.

Clifford H. Pope.—"A Snake-Buyer in China." With ills. *Asia Magazine*, Vol. XXVIII, No. 8, pp. 636-641; 680-682, August.

Clifford H. Pope.—"Frog Hunting in Fukien, China." With ills. *Natural History*, Vol. XXVII, No. 5, pp. 463-473, September-October.

L. B. Roberts.—"Two Mongolian Folk Songs." With ills. *Natural History*, Vol. XXVII, No. 5, pp. 489-402, September-October.

Arthur De C. Sowerby.—"Science Knows no Country." *The China Journal*, Vol. VI, No. 5, pp. 219, 220, May.

1927

ABSTRACTS

Charles P. Berkey and Frederick K. Morris.—"Pleistocene Deposits in the Eastern Altai." [Abstract.] *Bull. Geol. Soc. Am.*, Vol. 38, No. 1, pp. 126, 127, March.

Charles P. Berkey and Frederick K. Morris.—"Shabarakh Formation." [Abstract.] *Bull. Geol. Soc. Am.*, Vol. 38, No. 1, pp. 165, 166, March 30.

Charles P. Berkey and Frederick K. Morris.—"Climatic Pulsations in Mongolia." [Abstract.] *Bull. Geol. Soc. Am.*, Vol. 38, No. 1, pp. 211, 212, March 30.

1927

NOTES

Mr. Clifford Pope returned from Fukien Province, China, November, 1926. In December his collection of reptiles, amphibians, fishes and mammals reached the Museum. *Natural History*, Vol. XXVII, No. 1, p. 108, January-February.

Cable from Dr. Andrews announced he, Granger and Nelson safe in Peking; Young lost ends of two fingers by frost bite in Mongolia, Granger wrote March 24 from Hongkong, collections made by himself and Nelson were being forwarded. Collections from Yunnan Province include stone implements, fossils, bird and mammal skins, fishes and reptiles. *Natural History*, Vol. XXVII, No. 2, pp. 179, 180, March-April.

Mr. Clifford Pope studies amphibians of South China; describes breeding habits of frogs and toads of southeastern China; stresses habitat preferences and indicates importance of preferences in evolution. *Natural History*, Vol. XXVII, No. 2, p. 188, March-April.

On publication of "Fresh-water Fishes of Hainan." By John T. Nichols and Clifford H. Pope. Thirty new forms are described. All collected by Mr. Pope on his trip to Hainan in 1922; descriptions are accompanied by line drawings. *Natural History*, Vol. XXVII, No. 2, p. 189, March-April.

Exploration in China at standstill. Doubtful whether Third Asiatic Expedition will be able to resume work in Mongolia this summer. Peking authorities fearing supplies and equipment might fall into hands of Soviets. Mr. Granger and Mr. Nelson doing palæontological work in Yunnan, pending word from leader Andrews regarding resumption of exploration in Mongolia. *The China Journal*, Vol. VI, No. 4, p. 188, April.

Dr. Roy Chapman Andrews at meeting of American Geographical Society described work of last few seasons in Mongolia, outlined plans for future, gave account of methods employed for reconnaissance surveys for preliminary maps of the expedition. *The Geographical Review*, Vol. XVII, No. 2, p. 313, April.

Doubt is expressed as to whether the Third Asiatic Expedition will be able to continue work in Mongolia this summer. Dr. Andrews returned to Peking about middle of April. Mr. Granger and Mr. Nelson returned from Yunnan where palæontological work was carried on during the winter. *The China Journal*, Vol. VI, No. 5, p. 242, May.

Announcement of publication of first of Final Reports of the Expedition, Vol. II, "Geology of Mongolia" by Charles P. Berkey and Frederick K. Morris; also prospects of other volumes of this series. *Natural History*, Vol. XXVII, No. 3, pp. 293, 294, May-June.

Political conditions in China made it impossible for expedition to continue field work this summer. Staff with exception of Dr. Andrews, Young and Captain Hill returned to America. Granger returned to Museum, June 19, Nelson, June 28. Granger and Nelson spent winter in Province of Yunnan on reconnaissance work. Discovered deposits of early Pleistocene mammals and sites of early pre-Chinese culture on Yangtze River. *Natural History*, Vol. XXVII, No. 3, p. 293, May-June.

Leidy on the Central Asiatic Origin of Man. Recent article by Prof. Osborn entitled "Why Central Asia." *Natural History*, Vol. XXVII, No. 3, p. 304, May-June.

Letters received from members of Third Asiatic Expedition indicate attempts at further work this year have practically been abandoned. Messrs. Granger, Nelson, Olsen and Beckwith return to United States. Dr. Andrews and Mr. Young remain in Peking. Mr. Nelson writes he and Granger were able to do worthwhile work in northern Yunnan during past winter, securing archæological specimens of Neolithic character. *The China Journal*, Vol. VI, No. 6, p. 313, June.

November 8, 1926, before the Royal Geographical Society of London, Dr. Andrews presented comprehensive story of the five years' work by the Central Asiatic Expeditions in Mongolia. *Natural History*, Vol. XXVII, No. 4, pp. 395, 396, July-August.

Hazards of Expedition Work in Mongolia. Mr. McKenzie Young while on a trip to the winter quarters of the Expedition's camel herd in March, suffered from severe frost bite and loses the tips of two fingers. *Natural History*, Vol. XXVII, No. 4, pp. 396, 397, July-August.

Chinese opposition to foreign scientific expeditions in China. *The China Journal*, Vol. VII, No. 3, p. 143, September.

Mr. Walter Granger, palæontologist, Third Asiatic Expedition of the American Museum of Natural History, writes Mr. Sowerby from New York, August 18, 1927, in reference to the Chinese palm-civet

(*Paradoxurus larvatus*), quoted. *The China Journal*, Vol. VII, No. 5, p. 260, November.

Central Asiatic Expeditions hoping to continue Mongolian explorations in spring of 1928. In 1926-27 blocked from entering Gobi by generally disturbed conditions and warfare. In 1926-27 palæontological and archæological work carried on by Messrs. Granger and Nelson in Szechuen and Yunnan. Letters received from Andrews quoted. *Natural History*, Vol. XXVII, No. 6, pp. 633-634, November-December.

1927

FINAL REPORTS

Charles P. Berkey and Frederick K. Morris.—"The Geology of Mongolia," Vol. II. *Natural History of Central Asia*. The first volume to appear of the final reports of the Central Asiatic Expeditions. A Reconnaissance Report based on the Investigations of the Years 1922-1923. Pp. xxxi, 507. With 44 plates and 161 ill. in text; six maps in pocket at end. Copyright, The American Museum of Natural History. Printed by G. P. Putnam's Sons, New York and London, 1927 (1928).

1928

ARTICLES

Roy Chapman Andrews.—"Resumption of Work in the Mongolian Desert." *Nature*, No. 3051, Vol. 121, p. 647, April 21.

Roy Chapman Andrews.—"Gobi Bound." With ill. *The Saturday Evening Post*, Vol. 201, No. 19, pp. 8, 9; 79, 80; 82, November 10.

Roy Chapman Andrews.—"Desert Trails." With ill. *The Saturday Evening Post*, Vol. 201, No. 20, pp. 10, 11; 165, 166; 169, 170, November 17.

Roy Chapman Andrews.—"The Mongolian Colossus." With ill. *The Saturday Evening Post*, Vol. 201, No. 23, pp. 8, 9; 138, 140, 141; 145, December 8.

Ralph W. Chaney.—"Comparison of Certain Aspects of Tertiary History in Western America and Central Asia." *Bull. Geolog. Soc. Am.*, Vol. 39, No. 1, p. 268, March.

Laurence Empey.—"New Dragons of the Prime' Found in Mongolia." Remarkable Discoveries during the 1928 Central Asiatic Expedition of the American Museum of Natural History. With ill. *The Illustrated London News*, Vol. 173, No. 4665, pp. 454, 455, September 15.

H. J. Massingham.—"The Gobi Desert Discoveries." *The Saturday Review*, Vol. 146, No. 3814, pp. 717, 718, December 1.

Suyeo Nakano.—"Pre-Dawn Man." Roy Chapman Andrews Discusses His Unique Expedition—The Encouragement of a Single Tooth—Mixed Personnel of the Party. *The Trans-Pacific*, Tokyo, Vol. XVI, No. 23, p. 8, Saturday, June 16.

Clifford H. Pope.—"A 'Modern Medicine Man' in China." With ill. *Natural History*, Vol. XXVIII, No. 3, pp. 253-263, May-June.

R. Roshevitz, Principal Botanic Garden, Leningrad, Russia. (Communicated by A. S. Hitchcock). "A new representative of the grass genus *Timouria* from Mongolia."—Collected by R. W. Chaney on Third Asiatic Expedition of Amer. Mus. Nat. Hist. *Journ. Wash. Acad. Sci.*, Vol. 18, No. 18, p. 502, November 4.

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ABSTRACTS

Charles P. Berkey, Walter Granger, and Frederick K. Morris.—"New Stratigraphic Formations in Mongolia." [Abstract.] *Bull. Geol. Socy. Am.*, Vol. 39, No. 1, pp. 213, 214, March.

Ralph W. Chaney.—"Sequoia Forest of Oligocene Age in Manchuria." [Abstract.] *Bull. Geol. Socy. Am.*, Vol. 39, No. 1, p. 290, March.

Julie Moscheles.—"Die Geomorphologischen Ergebnisse der Zentralasiatischen Expeditionen des American Museum of Natural History." A synopsis, *Zeitschrift Geomorphologie*, Vol. IV, No. 1, pp. 19-31, Leipzig, October.

1928

NOTES

Before sailing from San Francisco, March 2, Mr. James B. Shackelford, photographer, joined Mr. Granger's party. A week later Alonzo Pond, archæologist, sailed from Seattle to meet party at headquarters in Peking. Dr. Andrews plans to start for Gobi Desert by mid-April. *Natural History*, Vol. XXVIII, No. 1, p. 106, January-February.

President Osborn gave farewell luncheon February 23 in Members' Room of Museum to Walter Granger, palæontologist, Leslie E. Spock, geologist, and Albert Thomson, preparator, who were to leave for San Francisco and China the following day. *Natural History*, Vol. XXVIII, No. 1, pp. 105, 106, January-February.

Cablegram from Dr. Roy Chapman Andrews states despite political handicaps field staff, including Dr. Andrews, Walter Granger, Alonzo W. Pond, and Leslie E. Spock, left Kalgan, April 14 to resume work in Gobi Desert. Prospect bright for successful season. *Natural History*, Vol. XXVIII, No. 2, p. 219, March-April.

The Central Asiatic Expedition cables reached Shara Murun beds, 350 miles from Kalgan; also, that Dr. Andrews had been accidentally shot in leg; injury not permanent, recovering satisfactorily. Remained with expedition, which will leave shortly for the western Gobi. Optimistic about work for this season. *Natural History*, Vol. XXVIII, No. 3, p. 330, May-June.

Dr. Andrews reports in letter of May 3, 1928, of most satisfactory progress, quoted. *Natural History*, Vol. XXVIII, No. 4, pp. 442, 443, July-August.

Dr. Andrews cabled from Peking, August 16, announcing return of Expedition from field and summary results of the season's work. *Natural History*, Vol. XXVIII, No. 5, pp. 555, 556, September-October.

The 1928 season of the Central Asiatic Expedition reached successful conclusion. Dr. Roy Chapman Andrews secured permission from the Nationalist Chinese Government to ship fossil material to American Museum. *Natural History*, Vol. XXVIII, No. 6, p. 665, November-December.

Recent dispatches from Roy Chapman Andrews, Leader, Central Asiatic Expeditions, stated Expedition is about to reach Shara Murun beds, 350 miles from Kalgan. *La Géographie*, Vol. 50, Nos. 5-6, p. 377, November-December.

"Finders of a New Titanotherium: Travel in 'Dinosaur Egg' Land." With ills. *The Illustrated London News*, Vol. 173, No. 4662, p. 332, August 25.

"A la Recherche de l'Eden." With ills. *L'Illustration*, Vol. 172, No. 4475, pp. 690-692, December 8.

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ARTICLES

Roy Chapman Andrews.—"Spectacular Beasts from the Mongolian Gobi." With ills. *The Illustrated London News*, Vol. 174, No. 4685, pp. 166-169, February 2.

Roy Chapman Andrews.—"The Dune Dwellers of Mongolia." With ills. *The Illustrated London News*, Vol. 174, No. 4687, pp. 278, 279; 294, February 16.

Roy Chapman Andrews.—"Further Adventures of the American Men of the Dragon Bones." With ills. *Natural History*, Vol. XXIX, No. 2, pp. 115-128, March-April.

Roy Chapman Andrews.—"Gobi Bound. I. A Scientific Expedition Visits the Mongolian Desert." With ills. *The World Today*, Vol. 53, No. 4, pp. 312-324, March.

Roy Chapman Andrews.—"Exploring the Gobi. II. The Early Civilization of the Dune Dwellers. With ills. *The World Today*, Vol. 53, No. 5, pp. 414-427, April.

Roy Chapman Andrews.—"Exploring the Gobi. III. The World's largest Mammal." With ills. *The World Today*, Vol. 53, No. 6, pp. 514-526, May.

Roy Chapman Andrews.—"On the Trail of Ancient Man." *Popular Mechanics*. With ills., Vol. 52, No. 1, pp. 82-86, July.

Roy Chapman Andrews.—"Explorations in Mongolia." With ills. *The Encyclopædia Britannica* (14th Ed.), Vol. 15, pp. 713-715.

Charles P. Berkey.—"Recent Geologic Explorations in Central Asia." *The Scientific Monthly*, Vol. 28, No. 3, pp. 193-216, March.

Charles P. Berkey.—"Orogenic Evolution in the Gobi Region of Central Asia." *The Structure of Asia*. Edited by J. W. Gregory, Prof. of Geology, Univ. Glasgow, pp. 206-211. Methuen and Co., Ltd., London.

E. Bertarelli.—"Alla Ricerca Dei Mostri Scomparsi." Ills. *La Rivista*, Anno VII-No. 5, pp. 72, 73, May.

Henry Fairfield Osborn.—Frontispiece—The Giant Baluchithere, colossal hornless rhinoceros represented in 1928 collection of Central Asiatic Expeditions. Drawn under direction of Professor Osborn by Miss Margret Flinsch. *Natural History*, Vol. XXIX, No. 1, January-February.

Henry Fairfield Osborn.—"The Revival of Central Asiatic Life." With three restorations under direction of Professor Osborn by Miss Margret Flinsch. *Natural History*, Vol. XXIX, No. 1, pp. 3-16, January-February.

Henry Fairfield Osborn.—"Interruption of Central Asiatic Exploration by the American Museum of Natural History." *Science*, New Ser., Vol. LXX, No. 1813, pp. 291-294, September 27.

Clifford H. Pope.—"Frogs from China." *Peking Society of Natural History Bulletin*, Vol. 4, Pt. II, pp. 11-14.

Clifford H. Pope.—"A List of Reptiles, known to occur in Fukien Province, China." Contribution from the Department of Herpetology

American Museum of Natural History. Reprinted from the *Proceedings of the Natural History Society of Fukien Christian University*, Foochow, China, Vol. II, pp. 20-22, June.

Arthur de C. Sowerby.—"The Future of Scientific Exploration in China." *The China Journal*, Vol. XI, No. 1, pp. 1-3, July.

Arthur de C. Sowerby.—"The Baluchitherium, the largest land mammal that ever lived." *The China Journal*, Vol. XI, No. 2, pp. 95-98, August.

Arthur de C. Sowerby.—"The Egg-Laying Dinosaur." *The China Journal*, Vol. XI, No. 3, pp. 147-150, September.

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ABSTRACT

Leslie Erskine Spock.—"Pliocene Deposits of Central Mongolia." [Abstracts.] *Bull. Geol. Soc. Am.*, Vol. 40, No. 1, p. 182, March.

1929

NOTES

Mr. Walter Granger and Mr. Albert Thomson spend winter in Peking, preparing specimens collected during summer. Mr. Young overhauls motors for next season's work. *Natural History*, Vol. XXIX, No. 1, p. 104, January-February.

March 1, Dr. Andrews sailed from San Francisco for Peking, to complete plans for next season's fossil collecting. On February 4, he was given a farewell luncheon by President Osborn. *Natural History*, Vol. XXIX, No. 2, p. 218, March-April.

Reports by Mr. N. C. Nelson on collection of archaeological material obtained in 1928 in south central Mongolia by Mr. Alonzo Pond. *Natural History*, Vol. XXIX, No. 2, p. 221, March-April.

Reference is made to what motor transport has accomplished by the American Museum's Expeditions into Mongolia. With ill. *The China Journal*, Vol. X, No. 5, pp. 270, 281, May.

News concerning Dr. Roy Chapman Andrews' expedition into Mongolia to effect that owing to rupture of negotiations conducted by Dr. Andrews and the Chinese Antiquities Preservation Committee, it has had to be cancelled. *The China Journal*, Vol. X, No. 6, p. 325, June.

Dr. R. C. Andrews gives interesting accounts of pursuit of the wild asses, with photographs taken on the Asiatic Expeditions from a motor car. *The China Journal*, Vol. XI, No. 3, p. 158, September.

Photograph of Mr. Walter Granger, chief palæontologist of the American Museum of Natural History's Asiatic Expeditions, with a short-toed chough (*Pyrrhocorax brachyopus*). *The China Journal*, Vol. XI, No. 3, op. p. 160, September.

The seventh year of the Central Asiatic Expedition. Details concerning the Expedition which have appeared in the public press. *Natural History*, Vol. XXIX, No. 5, pp. 552, 553, September-October.

On returning to the Museum, Curator Walter Granger will take up cataloguing of 1928 collection. An account of the winter's work in Peking laboratory is given and mention made of the description, by Prof. Osborn, of two extraordinary mammals from the 1928 collection: *Embolotherium* and *Amelclodon*. *Natural History*, Vol. XXIX, No. 5, pp. 557, 558, September-October.

Prof. Henry Fairfield Osborn, President of The American Museum of Natural History, in a communication to *Science*, states that the responsibility for the interruption of the work of the American Museum of Natural History in Mongolia is laid at the door of a Chinese Organization, the Society for the Preservation of Cultural Objects. *Science News-Letter*, Vol. XVI, No. 443, p. 211, October 5.

56.9,72(1181:51.7)

TWO NEW PERISSODACTYLS FROM THE ARSHANTO
EOCENE OF MONGOLIA¹

BY W. D. MATTHEW AND WALTER GRANGER

At the base of the Irдин Manha and Shara Murun formations are red clays generally barren, to which Berkey and Morris have given the provisional name of Arshanto formation. The only fossils found are two remarkable little perissodactyls, apparently related to the lophiodontoid

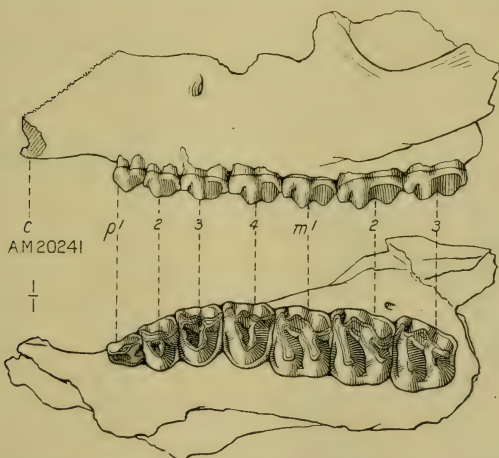


Fig. 1. *Schlosseria magister*. Upper jaw, external and crown views, natural size. Type specimen, No. 20241.

genera of the Irдин Manha and Ardyn Obo, but much more primitive. So far as the evidence goes the Arshanto may be Middle Eocene, but there is no correlation apparent with any Middle Eocene mammals of Europe or North America.

¹Publication of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 64.

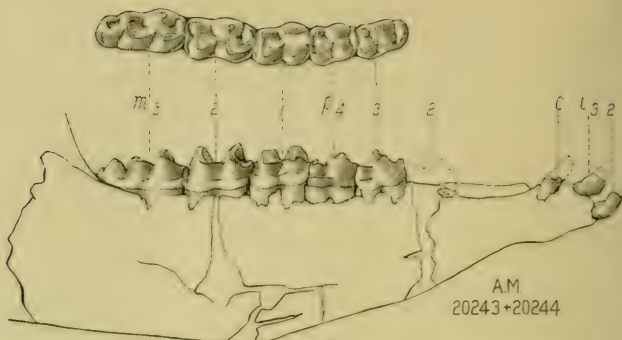


Fig. 2.

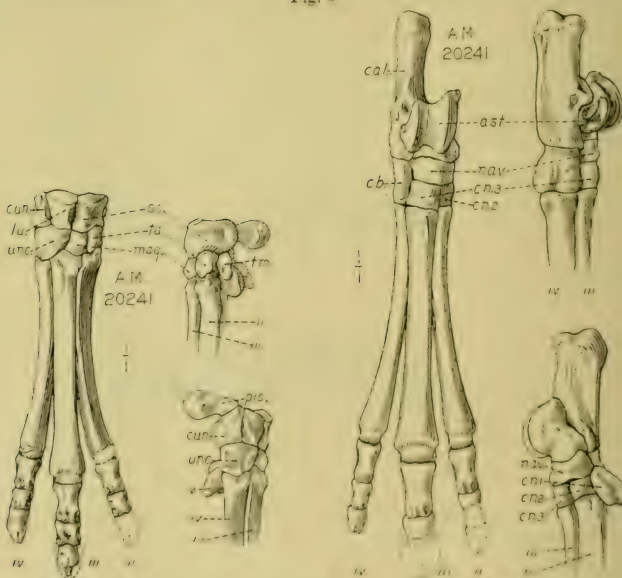


Fig. 3.

Fig. 4.

Fig. 2. *Schlosseria magister*. Lower jaw, external view and crown view of teeth, natural size. No. 20243; front teeth from No. 20244.

Fig. 3. *Schlosseria magister*. Fore foot, dorsal view; internal view of carpo-metacarpal joint; external view of same. All natural size. No. 20241.

Fig. 4. *Schlosseria magister*. Hind foot, dorsal view; external and internal views of tarsus. All natural size. No. 20241.

LIST OF THE ARSHANTO FAUNA

PERISSODACTYLA

Lophiodontidæ

Schlosseria magister. . . upper and lower jaws, fore and hind feet.

Hyracodontidæ

Teilhardia pretiosa. lower jaw.

Schlosseria magister, new genus and species

Named in honor of Max Schlosser, whose contributions to mammalian paleontology during the last half century have played so large a part in the advancement of the science.

TYPE.—No. 20241, upper and lower jaws, fore and hind feet.

HORIZON AND LOCALITY.—Lower red beds of the Irdin Manha formation, perhaps an older horizon than the Irdin Manha proper.

CHARACTERS.—Teeth patterned much as in *Heleletes*, but the metacones of molars flat instead of concave, a large looped heel on m_3 as in *Eohippus*, the oblique connecting ridges of the lower molar crests more developed than in *Heleletes*. Both fore and hind feet tridactyl, with long, slender metapodials and short phalanges. Anterior narial notch extended far backward, as in *Heleletes* and others of this family.

The size is about that of the Bridger species of *Heleletes*. Premolars more advanced in the completed wings of the protocone crescent on p^2 - p^4 and inner heel on p^1 . Second molar slightly larger than the first or third, and in all of them the transverse diameter is somewhat greater than the anteroposterior. A small vestigial nodule represents the first digit of the pes; the fifth digit of the manus is a short stout nodule strongly offset from the fourth metacarpal; the trapezium a smaller flattened nodule, similarly offset.

The teeth of this genus are in most particulars intermediate between *Heleletes* and *Eohippus*, but the molar pattern appears to relate it to the rhinocerotoid group, while the tridactyl manus distinguishes it from *Lophiodon*, *Heleletes* or the Eocene Equidæ. The only other known tridactyl genus in the Eocene is *Triplopus*, in which the teeth are more distinctly rhinocerotoid in pattern and there is no heel on m_3 . *Heleletes* appears to have a tetradactyl manus, and *Heptodon* of the Lower Eocene, very close to *Heleletes* in tooth pattern, certainly has four well developed digits in the manus.

The relationship to the Irdin Manha genus *Lophialetes* is hardly to be questioned. Although the feet of *Lophialetes* are not known, its teeth are directly derivable from those of *Schlosseria*.

***Teilhardia pretiosa*, new genus and species**

TYPE.—No. 20299, lower jaw, p_3 - m_3 r., from "lower red beds" at base of Shara Murun formation, Ulá Usu, Mongolia.

CHARACTERS.—Dentition, three lower premolars, three molars, the second premolar much reduced but still two-rooted, p_2 and p_4 considerably reduced, but submolariform. Molars slightly increasing from first to third, no heel on m_3 , cross crests rhinocerotoid much as in *Canolophus*. Posterior crests of p_3 and p_4 low and

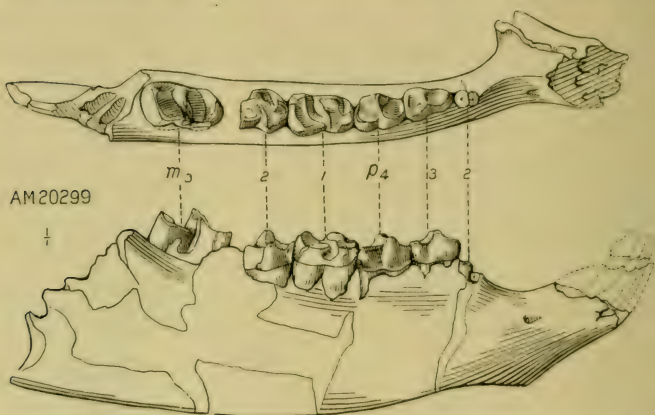


Fig. 5. *Teilhardia pretiosa*. Lower jaw, external and crown views, natural size. Type specimen, No. 20299.

imperfect, molar crests complete and rather strongly oblique, without any strong development of the internal pillars, and the external connecting crests in front of the transverse crests developed as in primitive rhinoceroses generally.

Length of premolar-molar dentition 55; of true molars 35 mm.

AFFINITIES.—This apparently is a hyracodont and suggestive of an ancestral type for *Ardynia*.

CORRELATION OF THE ARSHANTO FAUNA

It is by no means certain that the red beds at the base of the Shara Murun and those at the base of the Irdin Manha are really of the same age; nor in fact does the faunal evidence agree especially with that provisional correlation.

Schlosseria, although tridaetyl, is remarkably primitive in dentition, intermediate between the Middle Eocene *Heluletes* and the Lower

Eocene *Eohippus*. It comes from the red beds underlying the Irdin Manha, and might be regarded as Middle Eocene or even as Lower Eocene.

Teilhardia, found in the Arshanto beds beneath the Shara Murun, is not closely related to any Shara Murun or Irdin Manha perissodactyls, but might be ancestral to *Ardynia* of the Lower Oligocene. There is nothing to indicate that it is older than Irdin Manha.

Until further evidence is secured, these two interesting perissodactyls are provisionally associated in the Arshanto and tentatively correlated as Middle Eocene.

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SOME CHINESE FRESH-WATER FISHES¹

By J. T. NICHOLS²

XV.—TWO APPARENTLY UNDESCRIBED CATFISHES FROM FUKIEN

Bagrin catfishes in China show so much intangible variation, and so many species have already been described, that it is only after considerable reflection and with some hesitation that the writer ventures to name and describe the following forms from Fukien.

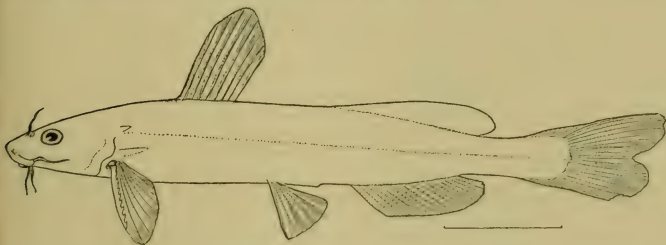


Fig. 1. *Leiocassis similis*, 119 mm. standard length.

***Leiocassis similis*. new species**

DESCRIPTION OF TYPE.—Number 8444, American Museum of Natural History, from the Min River, near Yenping, Fukien; collected by H. R. Caldwell.

Length to base of caudal 119 mm. Depth in length, 6; head, 4.4. Eye in head, 5; snout, 2.8; interorbital, 3.7; maxillary, 2.6; width of mouth, 2.5; maxillary barbel, 3.5; width of head, 1.4; depth of peduncle, 3; its length, 1.3; dorsal spine, 1.5; pectoral spine, 1.7; longest dorsal ray, 1.3; pectoral, 1.5; ventral, 1.7; longest anal ray, 1.8; caudal, 1.2; length of adipose, 1; its height, 4; dorsal interspace, 0.9.

Dorsal I, 7; anal 17.

Eye slightly superolateral; interorbital convex with a shallow groove in the center; head covered with skin; an uninterrupted bony bridge to the dorsal; orbital rim with a slight fold; barbels regular in position, 4 on a side, very small and thin; snout projecting beyond the transverse mouth; lips rather thick, slightly striate; gill membranes narrowly joined at base, free from isthmus. Dorsal origin at a distance

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 65.

²Drawings of type specimens by Mrs. Louise Nash.

from snout, 2.2 in its distance from caudal base; dorsal spine smooth or with 2 or 3 very weak serrations behind; pectoral spine strongly barbed on the inner (posterior) edge; pectoral reaching $\frac{2}{3}$ the distance to ventral, ventral not quite to anal; caudal weakly forked; adipose rather long and low, free behind.

Color dark purplish gray, including fins, little paler below.

This species is close to *L. emarginatus* Regan from Szechwan; probably with smaller barbels.

***Leiocassis crassilabris macrops*, new subspecies**

DESCRIPTION OF TYPE.—Number 8445, American Museum of Natural History, from the Min River, near Yenping, Fukien; collected by H. R. Caldwell.

Length to base of caudal 100 mm. Depth in length, 3.9; head, 3.7. Eye in head, 4; snout, 3; interorbital, 3; maxillary, 3; width of mouth, 2.4; maxillary barbel, 1.8; width of head, 1.4; depth of peduncle, 3.2; its length, 1.5; dorsal spine,

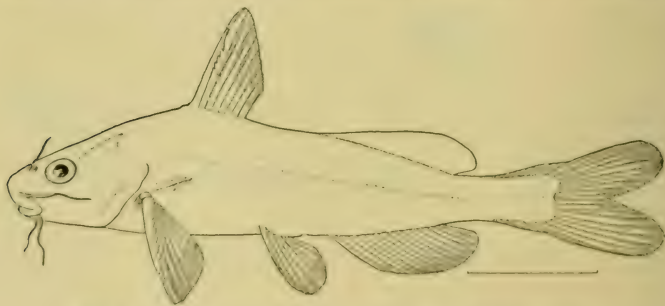


Fig. 2. *Leiocassis crassilabris macrops*, 100 mm. standard length.

1.5; pectoral spine, 1.7; longest dorsal ray, 1.2; pectoral, 1.3; ventral, 1.6, longest anal ray, 1.6; caudal lobe, 1.2; length of adipose, 0.9; its height, 4; dorsal interspace, 2.

Dorsal I, 7; anal 17.

Body compressed; eye somewhat superolateral; interorbital flattish, dropping to the eye at the side; snout rather soft and shapeless extending distinctly beyond the transverse mouth; with rather thick, slightly striate lips; orbital rim with a very slight fold, best marked below; top of head without skinless bone, the backward process extending to dorsal plate in a continuous bridge; gill membranes narrowly joined at base, free from isthmus; scapular process exposed, pointed, extending $\frac{2}{3}$ the length of the pectoral spine. Dorsal spine with slight serrations behind near the end; pectoral spine smooth in front, strongly barbed behind; pectoral reaching $\frac{2}{3}$ the distance to ventral; ventral past anal origin, rounded; adipose very low in front, high and free behind; caudal moderately forked, with keels on the peduncle above and

below; dorsal origin slightly nearer anal origin than end of snout, its distance from snout about 1.5 in that from base of caudal.

Color dark purplish gray, paler on belly, edges of dorsal caudal and anal darker.

This form has a larger eye than *Leiocassis crassilabris*, which we have from Tungting Lake and which it resembles sufficiently to be a geographic race or at least representative of it.

XVI.—CONCERNING GUDGEONS RELATED TO *PSEUDOGOBIO*, AND TWO NEW SPECIES OF IT

The best-known species of *Pseudogobio* is a small fish, *P. rivularis* from North China, of which *P. sinensis* is probably a race. It is quite unlike the various larger, more elongate Chinese species of *Saurogobio*, and evidently more closely related to the Japanese genus *Abbottina* (which thus becomes a synonym of *Psuedogobio*) than it is to them. The two small fishes about to be described are more or less intermediate between *Pseudogobio rivularis* and *Saurogobio*. It is possible that their true relationship is closest to *Saurogobio*, but this is uncertain. By the most convenient criterion to separate these two genera (scales more than 45, *Saurogobio*; less than 45, *Psuedogobio*), they fall in *Psuedogobio*. Were we to place them in *Saurogobio*, Japanese *P. esocinus* (Temminck and Schlegel), type of *Pseudogobio*, should be placed there also, *Saurogobio* becoming a synonym of *Pseudogobio*, *Abbottina* being recognized as distinct and including *Pseudogobio rivularis* and *sinensis*.

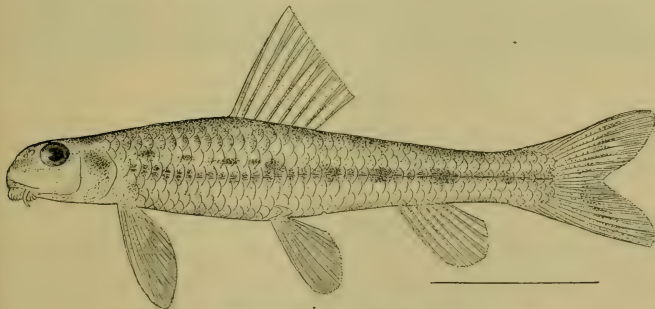


Fig. 3. *Pseudogobio chinssuensis*, 50 mm. standard length.

Pseudogobio chinssuensis, new species

DESCRIPTION OF TYPE.—Number 8446, American Museum of Natural History, from Chin-ssu, Shansi; collected by C. H. Pope.

Length to base of caudal 50 mm. Depth in length, 5; head, 4.7. Eye in head, 4; snout, 2.4; interorbital, 2.7; maxillary, 2.7; width of mouth, 2.9; width of body, 1.6; depth of peduncle, 2; its length, 1.5; pectoral, 0.8; ventral, 1.1; longest dorsal ray, 0.9; longest anal ray, 1.4; caudal lobe, 0.8. Barbel in eye, 1.3

Dorsal, 9; anal, 8. Scales, 39.

Body little compressed, the lower surface of head and breast flat, pectorals in a horizontal plane; vent at $\frac{3}{8}$ the distance from ventral axil to anal origin. Interorbital flat; eye placed high, slightly superolateral; mouth inferior, protractile downward. Maxillary not quite reaching to under front margin of eye; with a moderate sub-terminal barbel; lips moderately thick, papillose, with a heart-shaped flap across middle of chin; gill membranes broadly joined to shoulder girdle under middle of opercle. Dorsal and anal without spinous rays; dorsal origin midway between end of snout and middle of anal base; pectoral reaching $\frac{1}{2}$ the distance to ventral; ventral $\frac{2}{3}$ to anal; caudal moderately forked, with equal lobes. Lateral line complete, almost straight in the center, slightly bent down under origin of dorsal; no scales on breast, or mid-line of belly before ventrals.

Color brownish; about eight vague dark blotches along middle of side, and five or six on the mid-line of the back; double blackish spots at the tips (or bases) of the lateral line scales; upper part of opercle dark; a faint dark mark forward from and another down from the eye. Caudal with a faint curved dark cross mark; and two series of faint dark specks across dorsal.

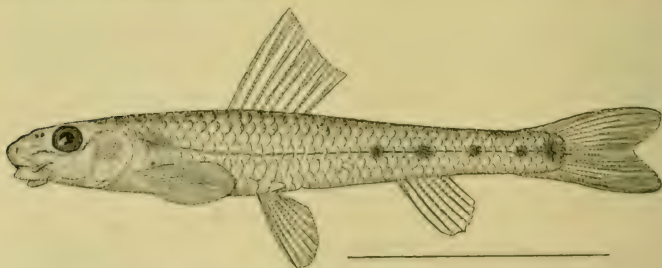


Fig. 4. *Pseudogobio tungtingensis*, 52 mm. standard length.

***Pseudogobio tungtingensis*, new species**

DESCRIPTION OF TYPE.—Number 8447. American Museum of Natural History, from Huping, Tungting Lake, Hunan; collected by C. H. Pope.

Length to base of caudal 52 mm. Depth in length, 6; head, 4.3. Eye in head, 3.2; snout, 2.4; interorbital, 4.5; maxillary, 2.7; width of mouth, 3; width of body, 1.7; depth of peduncle, 3; its length, 1.4; pectoral 1.2; ventral, 1.4; longest dorsal ray, 1.4; longest anal ray, 1.8; caudal lobe, 1.2. Barbel in eye, 1.3.

Dorsal, $9\frac{1}{2}$; anal, 8. Scales, 39.

Body little compressed; lower surface of head and breast flattened; pectorals in a horizontal plane; vent at $\frac{1}{5}$ the distance from ventral axil to anal origin. Top of head

very slightly convex; a broad shallow concavity on top of snout before nostril; eye somewhat superolateral; mouth small, inferior; maxillary not reaching to below front margin of eye; lips free all round, striate or papillose, a lobe in center of chin divided by a central groove; a rather stout subterminal maxillary barbel; gill membranes rather broadly joined to shoulder girdle. Dorsal and anal without spinous rays; dorsal origin equidistant from end of snout and anal axil; center of ventral situate behind center of dorsal base; pectoral reaching $\frac{5}{6}$ the distance to ventral; ventral $\frac{3}{4}$ to anal; caudal moderately forked. Lateral line complete, almost straight in the center slightly bent down under dorsal origin; breast scaleless backward to pectoral axils.

Color pale; scales on the back more or less margined with dark; four vague dark blotches on the back, the first at the dorsal origin; about six faint dark blotches on the mid-line of the side, from under the dorsal to the peduncle.

XVII.—TWO NEW RHODEINS

Our collections comprise considerable series of Rhodeins from the province of Anhwei, Tungting Lake, Chin-ssu in Shansi, and Hainan Island; also a few from Fukien and elsewhere. A number of species are represented, the following apparently identifiable with Chinese forms listed by Berg,¹ 1907: *Acanthorhodeus guichenoti*, *tonkinensis*, *tænianalis*, *atranaalis*, *Acheilognathus barbatus*, *himantegus*, *Rhodeus sinensis*, and *Pseudoperilampus ocellatus*. There are also *Rhodeus maculatus* Fowler and *Acanthorhodeus grahmi* Nichols, since described. If these determinations are correct, smooth *versus* serrated edge of the dental groove, the principal character used by Berg to separate *Rhodeus* from *Pseudoperilampus* and *Acheilognathus* from *Acanthorhodeus*, does not hold in his grouping, which otherwise seems to be a natural one. The two new species here placed in *Acheilognathus* are not closely related to each other.

Acheilognathus gracilis, new species

DESCRIPTION OF TYPE.—Number 8448, American Museum of Natural History, from Huping, Tungting Lake, Hunan; collected by C. H. Pope.

Length to base of caudal 44 mm. Depth in length, 3; head, 3.8. Eye in head, 2.5; snout, 3; interorbital, 2.4; maxillary, 3.5; width of mouth, 3.5; width of body, 1.6; depth of peduncle, 1.7; its length, 1.3; longest dorsal spine, 1.4; longest anal spine, 1.4; longest dorsal ray, 1.2; longest anal ray, 1.4; pectoral, 1; ventral, 1.3; caudal lobe, 0.7.

Dorsal II, 9; anal II, 7. Scales, 35; 4 between lateral line and ventral. Teeth (from a cotype) unusually compressed, all with entire edges.

Body compressed, the head rather broad, the snout blunt; an ovipositor between ventral axils which when depressed just passes anal origin. Interorbital flat across the top, convex at the sides; mouth distinctly inferior, transverse, curved, horizontal, the maxillary not reaching to below front of eye; without barbel. Dorsal origin equi-

¹Ann. Mag. Nat. Hist., (7) XIX, p. 160-163.

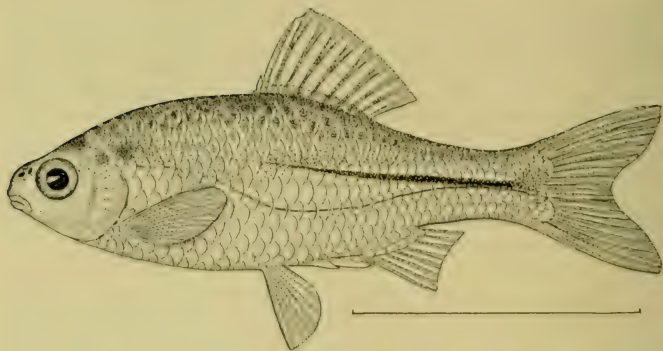


Fig. 5. *Acheilognathus gracilis*, 44 mm. standard length.

distant from end of snout and base of caudal; dorsal and anal spines well developed, the anterior not more than $\frac{1}{4}$ the length of the posterior; pectoral reaching $\frac{1}{2}$ the distance to ventral; ventral $\frac{1}{2}$ to anal; caudal moderately forked. Scales thin, without conspicuous striae; lateral line complete, moderately bent down under front of dorsal; entire base of dorsal and anal with a sheath of scales.

Color pale, a little darker along the back; an elongate dark blotch or smear on the front part of the lateral line; black "rhodein" streak pronounced posteriorly. Dorsal with 2 or 3 very faint cross-bands.

Besides the type there are four other specimens of about the same size.

***Acheilognathus barbatus*, new species**

DESCRIPTION OF TYPE.—Number 8449, American Museum of Natural History, from Ningkwo, Anhwei; September 15 to October 15, 1921; collected by C. H. Pope.

Length to base of caudal 40 mm. Depth in length, 2.3; head, 3.5. Eye in head, 3; snout, 3.5; interorbital, 2.8; maxillary, 4; width of mouth, 3.6; barbel, 5.5; width of body, 2; depth of peduncle, 1.9; its length, 1.5; pectoral, 1.4; ventral, 1.4; longest dorsal ray, 1.4; longest anal ray, 1.6; caudal lobe, 0.9.

Dorsal II, 10; anal II, 9; Scales 38. Pharyngeal bones and teeth (from a cotype) small, the latter sharply hooked, with slight blunt dentation along one side of the groove.

Body compressed; nape somewhat elevated; vent midway between ventral axils and anal origin. Top of head slightly convex; mouth small, oblique, with a double pimply saddle on the snout above it; jaws equal; maxillary not reaching to below front of eye; with a well-developed terminal barbel. Simple rays of dorsal and anal spinous; dorsal origin equidistant from base of caudal and middle of snout, immediately behind base of ventrals; pectoral barely reaching ventral origin; ventral

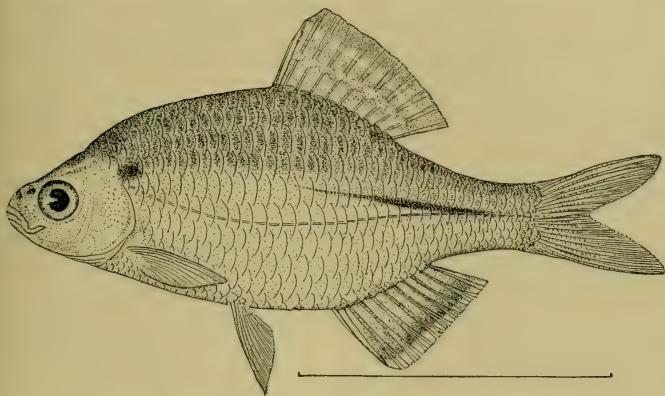


Fig. 6. *Acheilognathus barbatus*, 40 mm. standard length.

just reaching that of anal; caudal well forked. Scales with radiating striæ; lateral line complete, a little bent down under front of dorsal; anal with a low basal sheath of scales, that of the dorsal little developed.

Color gray, paler below, Black "rhodein" stripe short, broad and bold; a black spot at the upper axil of the opercle. Ventral, dorsal and anal dark gray; dorsal with a couple of faint paler cross-streaks; anal with a rather broad whitish margin.

Two specimens. The species is apparently close to *Acheilognathus limbatus* (Temminck and Schlegel) from Japan.

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RATS (GENUS *RATTUS*) FROM THE ASIATIC EXPEDITIONS¹

BY GLOVER M. ALLEN

Through the work of the Asiatic Expeditions of The American Museum of Natural History under the leadership of Dr. Roy Chapman Andrews, a magnificent series of over 1500 well-prepared skins of true rats (*Rattus*) has now been assembled from China, chiefly from the provinces of Yunnan, Fukien, Hainan, Szechwan, and Chili. A study of this collection in connection with previously published reports, especially those by Thomas and by Bonhote, affords a fairly comprehensive view of the distribution and variation of this group in China, though the relation of some of the species to Indian and Burmese representatives is still to be better worked out. In its general distribution the genus is one of warmer climates, with more species in the southern than in the northern half of China. Many of these, however, though perfectly distinct and possessing well-marked characters, are so similar in superficial appearance, size and color, that a careful comparison is often needed to establish their identity. As an aid to the general student, therefore, some of the chief characteristics of the several forms here mentioned are briefly given in connection with each, while those pertaining to the species are grouped in a key. Most of the species known from China are included in the collection. Of those listed by Bonhote (1906, Proc. Zoöl. Soc. London, 1905, p. 394), the species *ling* and *losea* were not identified, nor were specimens of the later-described *excelsior* (Thomas) taken.

KEY TO SPECIES OF *Rattus* LISTED

- A.—Belly white, sharply marked off from color of sides; its hairs white to the roots.
 - a.—Size large, hind foot 50–55 mm.
 - b.—Color browner, ochraceous and black above.....*edwardsi*.
 - b¹.—Color gray, grizzled.
 - c.—Chocolate brown, under fur sparse.....*mackenziei*.
 - c¹.—Grizzled gray and whitish, fur normal.....*latouchi*.
 - a¹.—Size smaller, hind foot 27–35 mm.
 - b.—Pelage very hispid, color bright ochraceous above....*huang*.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 66.

*b*¹.—Pelage slightly or not spinous in summer, color duller.

c.—Larger, hind foot 35 mm.

A dark area about the eye, tail tip white.

andersoni.

No dark eye-spot, tail dark all around. *rattus*.

*c*¹.—Smaller, hind foot 27-31 mm., belly with a slight yellowish tint. *confucianus*.

B.—Belly hairs slaty-based, at least medially.

a.—Lower surfaces washed with ochraceous, back of hands dark brown.

flavipectus.

*a*¹.—Lower surfaces tipped with whitish; feet white.

b.—Tail shorter than head and body. *norvegicus*.

*b*¹.—Tail usually longer than head and body.

c.—Larger, hind foot about 35 mm.; nasals ending posteriorly in a median point on a level with premaxillaries; outer anterior tubercle of *m*¹ reduced.

griseipectus.

*c*¹.—Smaller, hind foot 30-32 mm., nasals truncate posteriorly and shorter than premaxillaries; three anterior tubercles of *m*¹ well marked.

humiliatus.

***Rattus rattus rattus* (Linnæus)**

Mus rattus LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 61.

This is the common Black Rat introduced from Europe, with larger ears than the Brown Rat, and the tail proportionately longer, exceeding half the total length. It is apparently rare away from the coast, and its status even there is not altogether clear. The collections include but a single specimen from Kuliang, Fukien Province.

***Rattus rattus sladeni* (Anderson)**

Mus sladeni ANDERSON, 1878, 'Anat. and Zool. Researches Western Yunnan,' p. 305.

Kloss, who has reexamined Anderson's original specimens in alcohol from the Kakhyen Hills, western Yunnan, regards them as representatives of a valid race of *Rattus rattus*. The color is bright tawny above, mixed with black; below, pure white to the bases of the hairs, with a faint buffy tinge; hands and feet white; tail dark all around, averaging about 114% of head and body or 53% of total length, not so long as in some of the Indian races. Mammæ 3-3=12.

A series of thirty-three skins from various localities in western Yunnan is referred to this subspecies. Seventeen are from the Burma border, Namting River, at 1700 feet altitude; others are from the Salween and Mekong Rivers, at very slightly higher altitudes; while three from Tali Lake, at 6500 feet, and one from Pei-tai, forty miles

south of Chungtien, at 8000 feet, represent the highest elevations where the species was found. The last locality is also the most northern. While to some extent this is doubtless a house rat, it is nevertheless a natural wild species, and the series of skins is fairly uniform in color. Eight show a median gray stripe or blaze on the chest, and about a quarter of them have the central area of the backs of the feet darkened. To judge from the description, the race *khyensis* of Burma must be very similar to this.

Apparently no wild form of this species has been recorded from eastern China. Bonhote, in his review of Chinese rats in 1906, does not include it. It is therefore interesting to find three specimens from Fukien Province, collected by Rev. H. R. Caldwell for The American Museum of Natural History. Two of these are from Yuki, the other from Yenping farther inland. The collector's note records that the first two were taken in sword grass by the river bank. Although unaccompanied by skulls or measurements, these seem to be indistinguishable from the Yunnan specimens and are provisionally referred to the race *sladeni*.

***Rattus rattus hainanicus*, new subspecies**

TYPE.—Adult female, skin and skull, No. 59223, American Museum of Natural History, from Nam Fong, island of Hainan, China. February 15, 1923. Clifford Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Tail longer than in *R. r. sladeni*, averaging more than 120 per cent of head-and-body length; the dorsal coloring duller, more olive in general appearance, not so bright ochraceous as in the latter.

Dorsal surfaces nearly "yellow ocher" of Ridgway (1912), much duller than the "ochraceous buff" of *sladeni*, considerably darkened in the median area by long black hairs which are most conspicuous and somewhat hispid over the rump. The sides of the body and cheeks are grayer on account of the lack of black hairs and the showing through of the gray bases of the pelage in these parts. The backs of the feet are clothed with short, polished white hairs; the tail is dark all around, although two out of the series of ten show a tendency to a white tip, one of 20 mm., the other of about 3 mm., just below the end. The entire under parts of body and limbs are buffy white clear to the bases of the hairs, though in one specimen of the series a small gray spot is present at the center of the chest. Mammæ 3-3 = 12.

SKULL.—In comparison with material at hand, the skulls of the Hainan form of *Rattus rattus* show a very strong development of the supraorbital ridges which are broad and overhanging, with a prominent angle at the back of the orbit, whence they continue straight posteriorly to the parietal notch and thence less prominently to the outer corners of the interparietal. The incisive foramina are wider, more bowed outward than in Yunnan skulls referred to *sladeni*.

MEASUREMENTS.—The type was measured by the collector as follows: head and body, 180 mm.; tail, 222 (123% of head and body); hind foot, 31; ear, 24. In the dried specimen, the hind foot, with claw measured 33 mm.

The skull measures: greatest length, 44 mm.; basal length, 39; palatal length, 23.8; diastema, 11.8; zygomatic width, 20.7; width across postorbital angles, 11; mastoid width, 16.2; nasals, 16.2; upper cheek teeth, 7.8; lower cheek teeth, 7.8; length of bulla, 7.3.

In his careful study of the Indian House Rats, Hinton has lately shown that those from Sind, in western India, are "very different" from those in other parts of that country, and may provisionally be referred to the subspecies *alexandrinus*. To the eastward, *Rattus rattus* breaks up into various geographic subspecies, differing slightly in size, proportions, number of mammae, and color tone. The original, "wild" form is apparently white-bellied to the roots of the hairs with, in some cases, a gray pectoral spot. The gray-bellied forms seem to be urban, and more or less commensal with man. The relative scarcity of the "wild" type in southern China is shown by the fact that the Asiatic Expeditions secured only twenty-one in Yunnan and but three in Fukien while Bonhote did not include it in his review of Chinese rats. On Hainan it seems to be equally uncommon, only ten specimens in all having been taken at Nam Fong and Nodoo. In these, the long tails, duller coloring and heavily ridged skulls seem to separate them readily from the shorter-tailed and brighter-colored specimens of the two provinces mentioned. All are quite uniform in general appearance, while the tendency to the development of a white tail-tip is unusual in the species.

***Rattus humiliatus* (A. Milne-Edwards)**

Mus humiliatus A. MILNE-EDWARDS, 1868-74, 'Recherches Hist. Nat. des Mammifères,' p. 137, Pl. XLI, fig. 1.

A small rat, tail about 52 per cent of total length, hind foot about 31 mm., greatest length of skull (adult) about 38 mm. The color, although in general recalling that of the Norway Rat, is slightly more tawny and the black hairs of the back are so evenly distributed that they fail to make a darker dorsal area. The feet are white and the tail is usually slightly paler on the lower than on the upper side. The whitish of the belly is not sharply bounded laterally, and the hairs are mostly pale slate-color at base, though often pure white in the axillary region or at the sides. The nasals are squarely truncate posteriorly and exceeded in length by the prolongations of the premaxillae, while the three anterior tubercles of the upper first molar are nearly equal in size.

This species is apparently rare in collections. The type is supposed to have come from Peking or its vicinity but subsequent collecting there seems not to have revealed its presence. Bonhote states that it is absent from the collections made by Rickett, Styan, and La Touche, though he

records a single one from Nanking. He adds, further, that a specimen received from the Paris Museum as belonging to this species, and collected by Père David in western Fukien, proves to be *R. norvegicus*, so that the same mistake may have been made with supposed Peking examples. The collections of the Asiatic Expeditions include a small series taken in Fukien at Futsing and Yenping, and a very large number from the island of Hainan. I am unable to see any important difference in these two groups, though it is quite probable that they might be different from Peking specimens if any were available. The apparent scarcity of the species in North China make it seem questionable if Père David's original specimens were not after all from Fukien. In Hainan Mr. Clifford Pope found this the dominant species of the genus, abundant in the high grass and bushes bordering rice-fields, but less plentiful in the jungles.

***Rattus humiliatus celsus*, new subspecies**

TYPE.—Adult female, skin and skull, No. 43393, American Museum of Natural History, from Taku Ferry, west bank of the Yangtze River, Yunnan, China, 6000 feet altitude. November 20, 1916. R. C. Andrews and Edmund Heller, collectors.

DESCRIPTION.—Similar to *R. humiliatus* of southeastern China in size and general proportions, but longer-haired and lacking the bright buffy or cinnamon tone, which in this highland race is much paler; belly with a buffy tint instead of white.

General color above nearly "light ochraceous buff" of Ridgway, 1912, sparsely lined with black. The individual hairs are slaty-based with tips of "light ochraceous buff" or paler, about "pale ochraceous buff," the latter predominating at the sides of the body, and grading into the buffy whitish of the belly. Long black hairs line the entire upper part of the dorsal surface from nose to tail, darkening the lower back. Feet white. Lower side of limbs and body whitish with a buffy wash, the bases of the hairs grayish or pale slaty except on throat, fore limbs, axillæ and inguinal region, where usually the dark bases are lacking. Tail thinly haired. The minute setæ dark brown above, but distinctly paler below. Mam. 3-3=12.

SKULL.—In comparison with specimens from Fukien and Hainan, the skull differs in having slightly longer nasals which average about 15 against 13 mm. in adults. The supraorbital ridges in both series continue strongly backward to the point where the parietal suture makes an angle, beyond which the ridge is faintly but clearly traceable to the outer corner of the interparietal. The extreme width of the latter bone equals the distance from its outer angle to the antero-lateral corner of the parietal on the ridge. First upper molar with the three tubercles of its anterior row well defined and subequal; palate with a distinct median point at its posterior edge.

MEASUREMENTS.—The following dimensions of the type are from the collector's label; head and body, 160 mm.; tail, 198; hind foot, 33; ear, 22. Probably the tail measurement as given is too long. It averages about 51 per cent of total length. The skull measures: greatest length, 40.5; basal length, 35.3; palatal length, 22;

diastema, 10.4; zygomatic width, 19.5; mastoid width, 15.2; nasals, 16; upper cheek teeth, 7.6; lower cheek teeth, 7.5.

A series of nineteen skins from Yunnan is at once separable from the coast form by the longer pelage and grayer tone, with belly less white, and by the longer nasals. The series comprises eleven from Taku Ferry, west bank of the Yangtze, 6000 feet; one from Yunnan-yi, 6500 feet; one from forty miles south of Chungtien, 8000 feet; three from Hapa, 20 miles north of Taku, 10,000 feet; and three from Peitai Mountain, 10,000 feet. These localities indicate a considerable range for *humiliatus* as a species, from near sea-level to 10,000 feet.

In its more or less drab coloration the series from Yunnan closely resembles *Rattus griseipectus* superficially, but specimens may readily be distinguished from the latter by their shorter and relatively broader hind foot, the white hairs of which are coarser and less burnished; by the relatively shorter tail, and ear; and by the skull with its nasals truncate posteriorly and shorter than the premaxillaries, as well as by the characters of the first upper molar, with its three tubercles of the anterior row all clearly marked off and subequal.

***Rattus flavipectus* (A. Milne-Edwards)**

Mus flavipectus A. MILNE-EDWARDS, 1871, Nouv. Arch. Mus. d'Hist. Nat., Paris, VII, p. 93.

A species resembling the Norway Rat in general appearance, but with tail usually slightly more than half the total length, the fore feet with dark central areas instead of white, and the fur of the belly slaty at base tipped with buffy. The nasals are slightly shorter than the premaxillaries, and the supraorbital beading extends to the posterior edge of the parietal, flaring out laterally along the outer curve of the braincase.

This brown rat, in its distribution in China, seems to be mainly southern, though it reaches high country in Szechwan and Yunnan. It is recorded by Bonhote from Fukien and Kiangsi Provinces as well as from Formosa. The type was from Moupin, western Szechwan. Additional localities are furnished by the material from the Asiatic Expeditions. Rev. H. R. Caldwell collected a series in the mountains of Fukien near Yenping, and there are others from Futsing and Kuliang in the same province. In eastern Szechwan a few, including partly grown young, were taken late in the year at Wanh sien. The Duke of Bedford's expeditions apparently brought back none from this province, nor does it appear in the lists of species from Yunnan collected by Ward and Forrest. The collections of the Asiatic Expeditions, however,

include specimens from Yunnan-yi (6500 feet), one from Lichiang, 8200 feet (young), and three quite typical examples from Hsiao Tien, Mekong River (6500 feet), all in Yunnan. In addition, a single one was taken on the island of Hainan by Mr. Clifford Pope of the Third Asiatic Expedition and is an addition to the species known from the island. Although living as a wild species, this is frequently a house rat, coming into the native temples or dwellings.

***Rattus flavipectus yunnanensis* (Anderson)**

Mus yunnanensis ANDERSON, 1878, 'Anat. and Zool. Researches Western Yunnan,' p. 306.

This is a brighter-colored race with the belly nearly white and the yellowish wash usually restricted to the throat and middle area of the chest, where it may be intensified to a rusty tint.

In the lower country of southwestern Yunnan the representative of *R. flavipectus* is noticeably brighter in color and whiter-bellied, with the buffy wash usually more restricted. Anderson's name, based on specimens from "Ponsee, Hotha and Teng-yue-chow," is apparently applicable to it, and it should stand as a subspecies.

A series of fifteen adults was secured from the following places near the southwestern boundary: Mucheng, Salween drainage, 7000 feet; Changlung, Salween River, 2000 feet; and Namting River, Burma border, 1700 feet. Its relationship to the Indian representatives of the group remains to be shown, while structurally it seems very close to *R. r. sladeni*. Three skins from farther north, Hsiao Tien, seem to represent the typical subspecies.

As pointed out by Bonhote, the dark color of the backs of the fore feet is a very constant character. The buffy wash over the entire lower surface is fairly constant in *flavipectus*, but in *yunnanensis* it is rarely so extensive.

***Rattus griseipectus* (A. Milne-Edwards)**

Mus griseipectus A. MILNE-EDWARDS, 1871, Nouv. Arch. Mus. d'Hist. Nat., Paris, VII, p. 93.

A rat with much the general appearance of the common Roof Rat (*Rattus r. alexandrinus*) but grayer and with the tail about 50 to 52 per cent of total length. Among Chinese species it may be recognized by the abundance of longer black hairs in the mid-dorsal area, producing a darker, longer pelage than in *R. humiliatus* (which it may often much resemble when immature), by its long slender hind foot (35 mm.), with shining white hairs, its gray belly, and large papery ears. The skull,

compared with that of *R. humiliatus*, is larger, the braincase wider; the nasals end posteriorly in a median point on a level with the posterior ends of the premaxillaries, and the outer tubercle of the anterior row on the first molariform tooth is much reduced and usually not marked off by a vertical furrow on the front face.

This rat seems to be widely distributed across southern China. The type locality is Szechwan and it has also been recorded from Fukien. In the collections of the Asiatic Expeditions are specimens from these provinces as well as from several localities in western Yunnan from 1700 to 10,000 feet, from Hunan (Yochow), and from the island of Hainan. The last is the southernmost record of the species, which had not been previously recorded for the island. Three of the five skins from Hainan have a median spot on the belly where the hairs are pure white to their bases, instead of gray-based. They do not seem to differ in any important way, however, from the small series from Szechwan and Yunnan, which in general aspect are very uniform.

***Rattus norvegicus socer* (Miller)**

Epimys norvegicus socer MILLER, 1914, Proc. Biol. Soc. Washington, XXVII p. 90.

The indigenous race of the Brown Rat differs from that of Europe in its slightly smaller size, smaller hind foot (35-39 mm. instead of 40 or more), somewhat brighter color and slightly more hairy tail, which, as in the typical race, is shorter than head and body (46 per cent of total length). The skull, in addition to being less heavily formed, has usually a less wide interparietal, so that the width across the cranial ridges at the interparietal equals rather than exceeds the width at the postorbital angles.

This species is, as with us, a house rat. Seventeen specimens preserved from inland localities seem all referable to this race rather than to the introduced form from Europe, which doubtless occurs in the seaports. The localities are: Chili, Eastern Tombs; Shensi, near Feng-siangfu; Szechwan, Wanhsien; and Yunnan, Lichiang, 8200 feet. Two immatures without skulls, from Fukien, Yenping, seem to be the same.

***Rattus confucianus confucianus* (A. Milne-Edwards)**

Mus confucianus A. MILNE-EDWARDS, 1871, Nouv. Arch. Mus. d'Hist. Nat., Paris, VII, p. 93.

A slenderly formed rat, with tail about 56 per cent of the total length; above, a mixed ochraceous and black, the latter predominating

on the mid-dorsal area; below, clear white to the roots of the hairs, with a very faint yellowish wash. Feet white with dark metatarsal area. Summer coat spinous above.

As a species, this is common and of wide distribution over nearly the whole of China in suitable country, preferring hilly and rocky ground with at least a slight cover of vegetation. A very large series secured by the Asiatic Expeditions affords a valuable basis for comparison of specimens from distant parts of the range. Originally described from "Setchuan," the typical form is the darkest of the races, with the mid-dorsal area noticeably clouded by the long black hairs. The metapodials are also as a rule conspicuously darker; the tail is longer than head and body, averaging 56 per cent of the total length, either dark above and white below or with a white tip sometimes involving as much as a third of the length. In a series of 76 from Wan-hsien, Szechwan, 31 (40 per cent) have the tail white-tipped. Frequently the terminal white area is broken by little islands of dark in the mid-dorsal line, even including the tip. In nearly all, the buffy of the cheeks is continuous across to the muzzle, though rarely the white of the upper lip is produced upward to include a spot at the base of the whiskers. About a quarter of the series (19 in 76) have a spot in the center of the chest between the forelegs, varying from a very small tuft of hair with gray bases to a broader area, in one case 8 by 10 mm., with slaty bases and clear russet tips. In summer pelage many of the dorsal hairs are flattened and spine-like, but these are usually shed in late fall or early winter, so that January and February specimens have full soft fur.

In the highlands of central China this race covers an extensive area, including Szechwan Province, and extending southward into the mountains of Yunnan. A series from Lichiang, Yunnan, at 10,000 feet, taken in late October and early November, are all in soft winter coat. They seem indistinguishable from typical *confucianus* and Thomas has referred a series from the same region to that race. About half of those examined have a conspicuous white spot at the base of the whiskers as an extension of the usual narrow white edging of the upper lip.

To the eastward, the range doubtless extends across to the coast, for a series of skins from Fukien is practically similar to the Szechwan specimens, though perhaps a shade less dark above and the dark metatarsal area averaging less in extent and depth. Thus, in a series of 45, the feet are white or practically so in 25, while in most of the others the dark area is less well marked than in those from Szechwan. The difference, however, is extremely slight. To the north the length of tail

decreases, the colors pale somewhat, and at least one or two local races are recognizable. To the south, the colors become brighter as in Hainan or richer as on the Burma border.

***Rattus confucianus sacer* (Thomas)**

Mus confucianus sacer THOMAS, 1908, Proc. Zool. Soc. London, p. 6.

A paler, buffy-gray race, with tail long-haired and white-tipped, and the backs of the feet white.

This is typical in the Shantung peninsula, northern China; the type locality, Chefoo. Although the present collections contain none from Shantung, a large series from Yochow, Honan Province, is probably not very unlike this race, and the same is doubtless true of the series from Tai-pei-shan, Tsing-ling Mountains, Shensi Province, and from Fengsiangfu, Shensi. Indeed, Thomas considers Tsing-ling specimens intermediates between this and the typical race. Their feet average white, sometimes with the dark metatarsal area indicated by a buffy or grayish wash. The tail is usually white-tipped in (76 out of 84), and about a third have the white spot at the base of the whiskers. The winter pelage is apparently without spiny hairs. The subspecies is perhaps transitional to the following.

***Rattus confucianus chihliensis* Thomas**

Rattus confucianus chihliensis THOMAS, 1917, Ann. Mag. Nat. Hist., (8) XX, p. 199.

Differs from the typical form in having the tail shorter, about 49 per cent of total length, its tip penicillate and usually white above for as much as the terminal half.

The type locality is the Imperial Tombs, 65 miles east of Peking, Chili Province, whence a series of twenty-five was secured by the Asiatic Expeditions. In general color these are not very different from those taken to represent *sacer* in Honan and Shensi. Immatures are slightly grayer than adults. The dark metatarsal area is present in about half the series, and, while the summer skins are more or less spinous above, the few taken in winter are uniformly soft-furred. This seems to be the northernmost race of the species.

***Rattus confucianus luticolor* (Thomas)**

Mus confucianus luticolor THOMAS, 1908, Abstr. Proc. Zool. Soc. London, December 22, p. 45.

A paler and slightly smaller race than *sacer*. The type specimen is from Yeninfu, Shensi Province.

A small series of the sulphur-bellied rat from He-shuin, Shansi Province, is intermediate between the races *chihliensis* and *sacer* or *luticolor*, and is perhaps to be regarded as representing *luticolor*, which is typical along the southern edge of the Ordos Desert. Its differential characters are its smaller size and paler color as compared with *sacer*. The He-shuin series is decidedly more ochraceous than *chihliensis*, due to the fewer and more scattered black hairs mid-dorsally. The tail is relatively shorter than in typical *confucianus* or *sacer*, averaging 51 per cent (47-53) of the total length, but not so short as in *chihliensis* where it is about 49 per cent. The pelage in these December skins is devoid of spines.

***Rattus confucianus* (? near *bukit*) (Bonhote)**

Mus bukit BONHOTE, 1903, Ann. Mag. Nat. Hist., (7) XI, p. 125.

Specimens representing *confucianus* from the lower subtropical parts of western Yunnan on the Burma border tend to be more richly colored than the typical subspecies. Thus, several from Mucheng, 6000 feet, on the Salween River, are a deep ochraceous, almost ferruginous on the back, cheeks, and sides, even the backs of the hind feet being buffy in some cases. Others from Homushu Pass, 8000 feet, a little to the northward, are intermediate: some are quite as richly colored as those from Mucheng, while other individuals are practically like typical *confucianus*. These brighter specimens are doubtless to be regarded as variants approaching a richer-colored subtropical form which may be either *Rattus mentosus* Thomas of upper Chindwin, Burma, or possibly *Rattus bukit* Bonhote, described from peninsular Siam, but occurring also in northern Siam (near Chiangmai). The relationship of these two to *Rattus confucianus* must be very close, perhaps not more than subspecific, as nearly as can be judged from descriptions alone.

***Rattus confucianus lotipes*, new subspecies**

TYPE.—Adult female, skin and skull, No. 59303, American Museum of Natural History, from near Nodoo, island of Hainan, China. February 9, 1923. Clifford Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Characterized by the combination of brighter ochraceous coloring especially of the sides; the paler back; white feet lacking the dark metapodial area; the sharply bicolor tail (dark above, white throughout below); slightly sulphury belly; and by the spinous nature of the coat in winter as well as in summer.

The general coloring above is the usual mixed ochraceous and black, but the latter does not darken the pelage of the back to the extent that it does in typical

confucianus, while the former predominates laterally so that the sides of the head and neck, a spot behind the ears, and a narrow line at the sides of the body are nearly clear ochraceous. Some adult specimens are prevailingly ochraceous. In a series of over thirty specimens the tail is almost without exception dusky to the tip above, while its ventral half is clear white throughout lacking the dark pigment in the scales usually present in *confucianus* at least toward the base. The backs of the hands and feet are white, quite lacking all trace of the dark area on the metapodials. In some cases, however, there may be a slight buffy tinge to the basal part of the hind foot. The ventral surface of the body from chin to tail, including the lower surfaces of the limbs nearly to the ankles, is sharply marked off, sulphury white, notably yellower than in the neighboring races to the north. The upper lips are narrowly white, but in no case does this extend upward to form a white spot at the base of the whiskers as often in the typical subspecies, but always the ochraceous tint of the cheeks is continuous from the muzzle back along the sides of the head. The tail is less thickly haired than in the northern races.

SKULL.—Compared with typical *confucianus* the skull of the Hainan race presents no special peculiarities, except that in adults it appears slightly heavier, or may reach a slightly greater average size.

MEASUREMENTS.—The proportions of the body are practically as in the typical form, with the tail forming 56 per cent (average of 33 specimens) of the total length. The type was measured by the collector as follows: head and body, 135 mm.; tail, 180; hind foot, 30; ear, 21. The skull measures: greatest length, 39.5; basal length, 33.8; palatal length, 20; diastema, 10.3; zygomatic width, 16.5; mastoid width 14.5; interorbital width, 6.0; depth through audital bulla, 13; upper cheek teeth, 6.5; lower cheek teeth, 6.5.

The Hainan representative of this widely distributed rat is notably different from the typical form of Szechwan and equally so from the same race in Fukien, as well as from the other races to the north. In response to its warmer habitat, its colors are brighter, more ochraceous, and the whitish belly is more suffused with a sulphury wash. The feet are quite without the darkened central area, and the tail lacks the white tip and the darkening of the basal scales below so commonly found in the northern races. Unlike these, too, the pelage is spinous in winter (January, February, March specimens) as well as in summer. While the small dark chest-spot, occasionally seen as an individual variation, is usually absent, it is developed in one specimen so as to form a nearly complete collar, barely broken in the mid-line.

This species has not previously been recorded from Hainan, and its discovery is due to the intensive work carried out by Mr. Clifford Pope in 1922 and 1923. While the localities whence they came are given as Nodoa and Nam Fong, these are said by him to be inclusive terms, for many specimens were from the mountains some eight miles to the west.

Rattus andersoni (Thomas)

Epimys andersoni THOMAS, 1911, Abstr. Proc. Zoöl. Soc. London, February 14, p. 4.

A rat resembling *R. confucianus* in general appearance but much larger, with proportionally longer, white-tipped tail, and a purer-white belly; a dark area about the eye.

The single specimen on which this species was based was taken at Omisan, Szechwan, by Malcolm Anderson, but Thomas has since recorded specimens from the Mekong valley and the Mekong-Yangtze divide at from 6000 to 9000 feet. The series secured by Dr. Roy Chapman Andrews extends the known distribution to the Lichiang range at localities between 9000 and 10,000 feet altitude. These specimens have a shorter tooth row than recorded for the type (7.5 average, against 8.2 mm.) and are on the average smaller in other dimensions of the body but may for the present be considered identical.

Of interest as extending the known range of the species to what may be nearly its northernmost limit is a single individual secured at the base of Tai-pei-shan, Tsing-ling Mountains, Shensi Province. The skull shows it to be somewhat immature but it is not distinguishable from the Yunnan series. This wide-ranging rat affords, thus, another example of the uniformity of the fauna of the central Chinese highlands.

It is interesting that none of the Asiatic Expeditions secured *R. excelsior*, described from Szechwan. It is apparently a smaller but closely allied species, chiefly differing in size. The rat I described in 1912 as *Epimys zappeyi* from Wa-shan, in central Szechwan, is a form of it, differing so far as the single example shows, in its brighter color and restricted white area below, with the wrists dark all around. Unless future collections show that these points are purely individual, it may be regarded as another local race of that isolated mountain area, and should stand as *Rattus excelsior zappeyi*.

Rattus huang (Bonhote)

Mus huang BONHOTE, 1905, Abstr. Proc. Zoöl. Soc. London, No. 23, p. 19.

A brighter-colored rat than *R. confucianus*, which it resembles in size and color pattern. The white of the belly is purer, without buffy wash, the ear is slightly shorter, the pelage more hispid, and the skull with the flaring temporal ridges more strongly marked and continued conspicuously to the corner of the interparietal.

This is a common species in Fukien Province, and a large series was taken also on the island of Hainan. The two lots seem to be quite

indistinguishable. Rev. H. R. Caldwell, who collected most of the Fukien specimens, notes on the label of a January 29 skin, "nests in trees." In two cases embryos are noted: two on July 28, three on August 2, indicating small litters. This is apparently a species of southern China.

***Rattus huang vulpicolor*, new subspecies**

TYPE.—Adult male, skin and skull, No. 43297, American Museum of Natural History, from the Nanjing River, at the Burma border, altitude 1700 feet. February 23, 1917. R. C. Andrews and E. Heller, collectors.

DESCRIPTION.—Similar to *R. huang* of Fukien, but with a proportionally longer tail, slightly smaller skull, and much more vivid fulvous coloring above.

General color above, from forehead to base of tail a bright fox-color, nearly "ochraceous orange" (Ridgway, 1912), lined in the mid-dorsal area with black, but becoming nearly clear on the cheeks, sides of body and upper sides of fore and hind limbs. The individual hairs are slaty at base, with bright fulvous tips, intermixed with black-tipped bristles the bases of which are slaty. The muzzle is duller, brownish. Below, from chin to vent, including the lower sides of the fore-limbs to the wrists, a narrow edge of the upper lip, and the inner side of the hind legs nearly to the ankle, pure white to the roots of the hairs, with, however, a faint buffy tint over the chest and upper abdomen, a region where the hairs are very slightly hispid. The base of the tail all around is fulvous and the ankles are dusky fulvous. The backs of the feet have a narrow dusky median area mixed with buffy, and passing into clear buff toward the sides of the feet, which with the toes are clothed above with short white hair. The tail is sharply bicolor as in *R. huang*, dusky above to the tip, clear white below to the extreme end.

SKULL.—Compared with that of *R. huang* the skull of this race is slightly smaller and more delicate, but otherwise resembles that of the typical form. The prominent supraorbital head is continued directly backward to the interparietal border instead of stopping short of it as in *R. confucianus*. The audital bullae are small as in the latter and in typical *huang*. The incisive foramina reach just to the level of the molar tooth rows. The nasals very slightly exceed the premaxillaries in backward extent above, and end about on a line joining the anterior margins of the orbits. The interparietal ends anteriorly in a blunt median point, rather more prominent than in *R. confucianus*.

MEASUREMENTS.—The type was measured in the flesh as follows: head and body, 140 mm.; tail, 203; hind foot, 31; ear, 20. It is slightly the largest of the six specimens. The ratio of tail to total length is 59 per cent in the type and a second example, 58 per cent in three others, and 57 per cent in the youngest specimen, whereas in a series of *R. huang* from Fukien, the tail is from 54 to 57 per cent of total length, averaging 56 per cent.

The skull of the type measures: greatest length, 36 mm.; basal length, 30.1; palatal length, 17.5; diastema, 8.5; zygomatic width, 16.3; mastoid width, 13.8; interorbital width, 6.4; width between outer corners of anterior cheek-teeth, 6.8; upper tooth row, 6; lower tooth row, 6.

This is obviously the representative of *R. huang* in western Yunnan, where, however, it must be uncommon, for careful collecting by such

skilful naturalists as Andrews and Heller resulted in the capture of but seven individuals, four of which are from the Namting River, Burma border, at the low altitude of 1700 feet, the others from Yang-pi River, Teng-yueh road, 5000 feet, and Mekong River, 8000 and 9000 feet, respectively. The last two are young adults, and are less spiny than those from the lower level, though all are winter specimens (December to February); indeed, the Yang-pi individual is practically without spiny hairs. As indicated by the known localities in Fukien, Hainan, and, now, western Yunnan, the range of *R. huang* as a species is evidently much more southern than that of *R. confucianus* to which it is allied. Bonhote, in describing it, regarded his *R. rapit* of Borneo as its nearest ally, but apparently no representative of the species has yet been discovered in the intermediate region of the Malay Peninsula, nor can I, from a careful comparison of descriptions, feel sure that any of the many forms of the genus known in eastern India is to be regarded as representing it. The discovery of this rat in western Yunnan is thus a considerable extension of the previously known range of the species. The new race is a very beautiful, delicately formed rat, much exceeding the typical eastern race in the bright coloring of its pelage.

***Rattus mackenziei* (Thomas)**

Epimys mackenziei THOMAS, 1916, Journ. Bombay Nat. Hist. Soc., XXIV, p. 411.

A large rat (hind foot 51–55 mm.), chocolate brown above, grizzled with gray ticking, under fur sparse; below pure white to the roots of the hairs; feet mostly white with dark ankles and central metatarsal area; tail nearly uniform dark, sparsely haired, with or without a white tip or white under side.

Three specimens of this rat extend its known range from Burma (Chin Hills) into China. Two were taken at Mucheng, Salween drainage, 7000 feet altitude, and one at Ho-mu-shu Pass, 8000 feet. In general appearance they recall *R. latouchei* but are browner, with almost no soft under fur on the back. The amount of white on the tail, as usually with albinistic markings, seems to vary greatly. Thomas describes the type as having the terminal two-fifths white. In the race *fax* from Tenasserim, only the extreme tip is white, while in the three from Yunnan, only one has a short white tip (20 mm.). In a second the tail is whitish throughout below, though the scales at its base are pigmented, while in the third the tail is almost uniformly dark as to both hairs and skin. In one there is a median white stripe on the forehead.

Rattus edwardsi (Thomas)

Mus edwardsi THOMAS, 1882, Proc. Zool. Soc. London, p. 587, Pl. XLIV.

A very large, gray-brown rat, with buffier sides, pure white belly and white-tipped tail. The feet are dark-centered with silvery-white sides and toes; foot about 55 mm.

This species does not seem to have been secured in China outside of Fukien Province, unless Satunin's *Mus gigas* from Szechwan is the same. In the small series at hand, adults in summer pelage are somewhat spiny, while others taken in November and December, though with many stiff, bristly hairs in the dorsal pelage, are less spiny. An adult trapped July 28 contained two embryos. The mammae are 2-2=8.

Rattus latouchei (Thomas)

Mus latouchei THOMAS, 1897, Ann. Mag. Nat. Hist., (6) XX, p. 113.

A gigantic species of the size and general appearance of *R. edwardsi* but the dorsal coloration a mixed gray-brown and white, giving a uniform pepper-and-salt effect. The line marking off the pure white of the belly is less sharply defined.

A single skin from "northwestern Fukien" is practically a topotype of this little-known rat.

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GEOLOGY AND PREHISTORIC ARCHÆOLOGY OF THE Gobi DESERT¹

BY CHARLES P. BERKEY AND N. C. NELSON

55.1, 79(51.7)

The Third Asiatic Expedition, from the beginning of explorations in the Gobi desert region, has hoped to find somewhere the record of prehistoric man. Finds that could be linked definitely with features or deposits of known age were not discovered on the first reconnaissance. But the geologic factors that enter into the problem were partially solved, and it was fully appreciated that in the absence of caves and cave deposits, and in the absence also of glaciation and glacial deposits, it would be necessary to search for regularly formed sedimentary strata of late geologic time, which might carry the record. Such formations had not been clearly identified before, although there was reason to believe that they might exist, so the Expedition determined to give special attention to this problem during the field season of 1925.

GEOLOGY

BY CHARLES P. BERKEY

In earlier announcements,² attention has been called to the dominance of Pleistocene and Recent erosion. Valleys made by former streams and hollows made by the wind may be seen on every side. Erosion on so large a scale must have been accompanied by deposition of the same material elsewhere; yet if such deposits were found they might furnish little evidence. Localities exhibiting recent deformation must be sought because only such places present the special conditions favorable to dissection and exposure.

Selective erosion, especially erosion by wind, would, of course, favor the residuary accumulation of heavy indestructible materials on the surface, including both those permanently exposed and those formerly covered. Any of the present-day surfaces, therefore, could

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 67.

²Berkey, Charles P., and Granger, Walter, 1923, 'Later Sediments of the Desert Basins of Central Mongolia,' American Museum Novitates, No. 77, May 25. Berkey, Charles P., and Morris, Frederick K., 1924, 'The Peneplanes of Mongolia,' American Museum Novitates, No. 136, October 16. Berkey, Charles P., and Morris, Frederick K., 1924, 'Basin Structures in Mongolia,' Bull. Amer. Mus. Nat. Hist., LI, Art. 5, October 7.

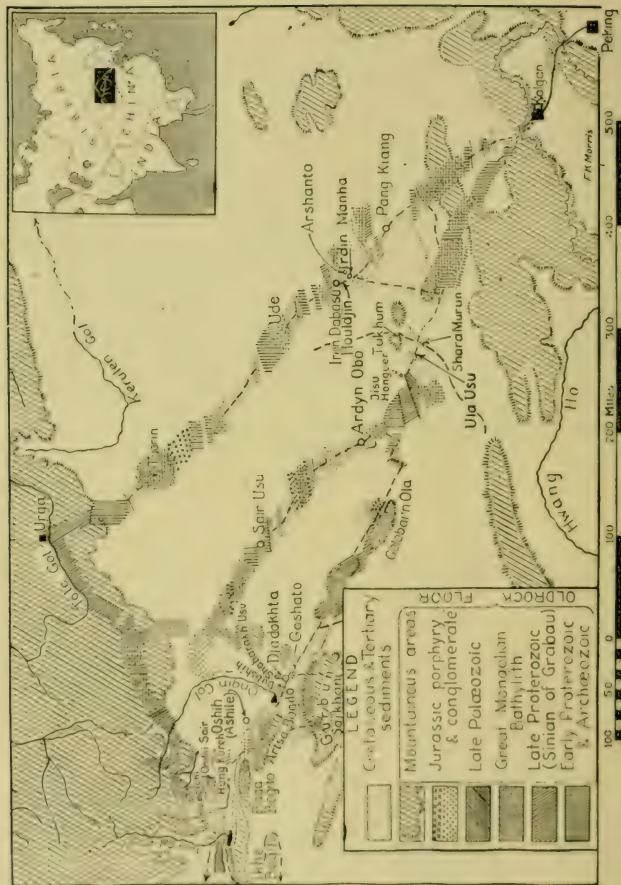


Fig. 1. Sketch map of central Mongolia, showing the principal geologic formations along the routes followed by the Central Asiatic Expeditions of 1922, 1923, and 1925, and the localities that have proven to be of special importance.

The type localities illustrating the occurrence of artifacts, Jisu Honguer, Khodoholei, Hong Kureh, Dulshih, and Shasharakh Ussu, are distributed along the southerly route.

carry traces of man; and a mixture of artifacts, representing a succession of cultures, is likely thus to be found together without any means whatever of separating them into definite stages or attaching them to definite horizons. Where the underlying strata are old, no special problem arises, but in places where Quaternary or Recent deposits form the floor, the additional problem is presented of determining how much of the surface find is residuary and therefore to be dated with the strata of the floor.

On account of these possibilities few of the finds have a simple history. The great majority are mixed lots, and at some of the most prolific sites several depositional horizons are represented in the residuary material left from extensive selective denudation. In places, however, where erosion has left a particularly irregular surface, exposing considerable thickness of deposits, the geological conditions are favorable for artifacts to be found in situ.

By all means the most promising localities for such finds, accompanied by adequate geological evidence, lie in the basins bordering the north side of the Altai ranges from the Gurbun Saikhan on the extreme east to Ikhe Bogdo 200 miles farther west. This is a region of very late deformation resulting in repeated renewal of mountain uplift and local depression, both of which tend to increase erosion and corresponding deposition. Here deposits of Pleistocene age were laid down under especially favorable conditions.

In addition there are other deposits, not related to deformation at all, wholly due to the work of wind and water under varying conditions of changes of climate. Such deposits link the story with the present time, for the same processes are still operative, shifting from deposition to erosion or from erosion to deposition with each cyclic swing of the pendulum of climatic change.

These are the general geologic conditions under which all of the human traces have been found in the Gobi. Deposits that bridge the time interval of major archæologic interest have been found, and their geologic relations and meaning are determinable, so that the physical conditions of the time can be read. There are no caves or shelters. Every artifact is either in the open or involved in deposits of regular sedimentary formation.

Under more detailed analysis one can distinguish five types of conditions presented by these features as follows:

TYPE 1.—Localities of ancient strata characterized by surface finds only.

All areas underlaid by ancient rocks and by strata older than the Pleistocene, or possibly the Pliocene, belong to this type. These strata were accumulated before

human artifacts were available, so that there was never any chance of their being buried in the sediments of the time. No matter how many successive peoples may have occupied these localities, the different cultures must be mingled in a more or less confused surface accumulation whose thread of history is so tangled that it cannot be unraveled. There is no way of associating the different elements with definite geological formations so as to determine their age.

Such a locality is that of Jisu Honguer, about 300 miles northwest of Kalgan. The rock floor is Paleozoic strata and the still more ancient graywacke series. There are no Tertiary, Quaternary, or Recent deposits except the thin patches of soil. There are traces of human cultures on the surface, but there is no geological way of determining their age, because the present surface is the product of very much longer time than is represented by the whole succession of cultures.

TYPE 2.—Localities characterized by surface finds only, but where the immediate floor consists of Pleistocene deposits.

In localities where strata of late geologic age form the floor, surface finds have a greater potential significance. This is especially true where the present surface has been produced by long erosion, for it is clear that artifacts found on such a surface might have been exhumed by the agents that have been removing the strata. In that case the artifacts must be at least as old as the strata of which they formed a part. It is equally true, of course, that such materials might always have been on the surface, not having been at any time a part of the sedimentary formation. In the latter case they are younger than the strata, and may belong to any age from that time down to the present day.

It is of prime importance, therefore, in this type of locality to discover, if possible, whether or not there are artifacts of this kind still buried in the undestroyed portion of the strata. Failure to find such content in situ does not necessarily prove that they do not belong there, but it leaves one in a state of uncertainty as to their age.

Kholobolchi Nor is a locality of this kind. Very primitive forms (coliths) and paleolithic artifacts were found here on the surface. The underlying strata are of Pleistocene age. The area has been undergoing erosion probably ever since mid-Pleistocene time. There are great numbers of residuary fragments left lying on the present surface, mixed of course with other fragments that were never buried. The primitive character of the artifacts, together with the known Pleistocene age of the strata, lead one to believe that this culture material may have been covered up there with the sediments as they were deposited. It would be a most important step in age determination if some of the artifacts could be found in place, but thus far in this locality they have been found on the surface only. Because of the age of the strata and the primitive character of the finds, this is one of the most important localities yet found in the Gobi region. It deserves a more extended inspection directed specifically to finding these artifacts in place in the Pleistocene strata. The probabilities are that they belong there, and that those found on the present erosion surface are essentially residuary.

TYPE 3.—Localities characterized by surface finds only, where sedimentary deposits of Recent age form the floor.

In occasional places with special surroundings, deposits of Recent age have been accumulated. By reason of a change of physical condition, some of these deposits are undergoing erosion at the present time. Many of these localities furnish artifacts on

the surface. It is clear that here again there is more or less uncertainty about the age of the materials. They are necessarily all Recent because even the floor is of that age; but whether the finds belong to the deposit and have been exhumed, or belonged originally to the surface, and have been let down, as the floor was etched out beneath them, one cannot determine unless an occasional artifact can be found in place. Evidently the surface finds may have any age from that of the sedimentary deposit itself down to the present day.

There are many small localities, or sites, of this kind, especially along the bottoms of ancient valleys where a portion of their later history includes a stage of valley filling and sand dune development. Such a locality is Dubshih, north of the Gurbun Saikhan on the Kobdo trail, 20 miles west of Djadokhta.

TYPE 4.—Localities characterized by separable Pleistocene members and Recent deposits where as yet no artifacts have been found.

The type locality for these conditions is the north side of Baga Bogdo mountain range in the Hung Kureh district. There, some of the vicissitudes of Quaternary times have been registered in a striking series of reversals of geologic processes. There have been epochs of deposition, marked by the development of enormous alluvial fans derived from Baga Bogdo extending many miles out into the bordering basins, alternating with corresponding epochs of erosion and dissection when trenches and even large valleys were carved into and across the deposits. Deformation accompanied some of these changes and this aided materially in producing the critical structural conditions that now make interpretation possible.

With these factors one can make out at least two epochs of prominent deposition alternating with epochs of erosion or dissection. The earliest of these alluvial deposits as thus defined carries early Pleistocene fossils. Both of the deposits must be of Pleistocene age, but the second has not thus far furnished faunal evidence. The epochs of erosion are believed to correspond to the times of the ice advance, or principal glacial epochs of Europe and America. These ought to be times of cooler and more humid climate on the whole in northern Asia also. But the interglacial epochs are believed to correspond to the times of maximum alluvial fan development due to reduced stream flow and greater aridity. The last important erosion epoch in central Asia is judged to represent conditions corresponding to the last glacial advance of the Ice age. The deposits formed since that epoch, which have partly covered the valley bottoms of that time, are judged to be Recent, and they carry the record to the present day.

Here at the base of Baga Bogdo is a great series of deposits probably more than 2000 feet in total maximum thickness, physically separable into at least three members, covering portions of the Age of Man, distributed from early Pleistocene time to the present, which offer exceptional opportunity for exploration. If man lived there during this time, the geologic conditions were favorable for recording his history. Nowhere else in the Gobi region have we seen such a readable display of modern geological deposits.

TYPE 5.—Localities characterized by finds both on the surface and in situ.

Such conditions are rare, but they have greater interpretative possibilities than all others together. The type locality for this region is Shabarakh Usu, 700 miles northwest of Kalgan on the Kweihwating-Kobdo caravan trail, in the Djadokhta district in the central Gobi. Others of less prominence were inspected.



Fig. 2. Alluvial fans of the north side of Baga Bogdo. Hung Kureh lies on the outer margin of these fans. There are three epochs of fan building, two of Pleistocene age and one Recent, separated by two epochs of erosion. No artifacts have as yet been found in these deposits.

At Shabarakh there is an ancient river valley eroded to a depth of over 400 feet below the general level of the Gobi planation surface. It could not have been made under present climatic conditions. There must have been enough of a stream in some former time to do this work. Now there is no stream at all. Closer inspection shows that the sediments, now well exposed by present-day erosion, which is accomplished chiefly by the wind, are not the same as those forming the sides of the valley into which the river trench is cut. Whereas the strata of the valley side carry dinosaur bones of Cretaceous age, these sediments in the valley bottom carry only fragments of modern forms and human artifacts. The differences in lithologic character of the two lots of sediments throw further light on the matter. The valley bottom material exhibits evidence of deposition under rainwash and torrential conditions alternating with spells of wind action, and with development of dune sands as time went on. The lower beds are therefore dominantly torrential sands, alternating with silts laid down in small ponds of standing water, whereas the higher beds show more and more the features of wind-blown material.

Topographically the valley bottom shows certain abnormalities also. The cross profile of the valley is not regular, and the longitudinal profile and gradient are likewise more irregular than one would expect for a valley eroded in uniform sediments. These irregularities suggest obstruction of the valley by deposits of some kind.

Clearly the whole series of observations, coupled with those made in the adjacent Altai Mountains, which there is not space to discuss, support the following explanation. The original Shabarakh valley was eroded to its maximum depth under much more humid conditions than the present. There was enough rainfall to maintain an active river, and to support vegetation on the valley slopes, which were thus protected from excessive rainwash and under these conditions maintained a smooth outline. But there came a permanent change of climate that has prevailed with only minor variations ever since that time. The region became more and more arid and there was insufficient water to maintain enough of a stream to continue valley erosion. Increasing aridity resulted in destruction of vegetation, so that the valley slopes became bare and thus lost their protection against attack by the infrequent rains and the more constant winds. The occasional rain storms therefore caused excessive wash of soil from the steep valley sides, and this débris collected in the valley bottom, whence it could not be removed by the reduced stream. In the intervals between storms, the winds whipped the dried sands about and piled them into dunes and shifted them along the valley bottom, thus adding to the irregularity of distribution. This combination of processes must have continued for a long time, for the valley bottom became more and more heavily covered and obstructed with these deposits.

The increasing aridity resulted first in the loss of permanent stream flow, but for a time there were still struggling intermittent streamlets and transient pools dammed in by the obstructing wash from the valley sides. In these pools the finer sediments were collected, but ultimately even these ponds were dried up, so that there was water only occasionally after a storm or during the rainy season. Finally, after layer upon layer of such deposits had been accumulated, the climate became so much more arid that even the rainwash from the valley sides was not sufficient to balance the destructive work of the wind, which, with perhaps increasing vigor, continued its attack on the lower sands. So effective and dominant had wind erosion become by this time that the finer sands were carried entirely out of the valley, and the attack continued on the underlying deposits. Thus erosion has continued with

short periods of reversed conditions down to the present day. This deposition history, followed by the reversal of operations from deposition to erosion, is fully recorded in the bare and much-dissected remnants of strata, where one can see every structural detail.

These are the deposits in which and on the surface of which the artifacts registering the occupation of man have been found at Shabarakh Usu. A primitive race of men lived in the valley bottom along the course of the ancient stream. As the conditions changed on the last great cyclic swing toward a warmer and more arid climate, they gathered into the valley bottom, the only place where water could be obtained, and in this way they held out for a long time against the increasing privations of the encroaching desert. Repeatedly the sites of their hearths and workshops were flooded and overstrewn with wash from the hillsides due to a sudden storm, and the products of their workmanship were covered to become part of the permanent sedimentary deposits. Such experiences must have continued for some thousands of years, until the accumulation filled the whole valley bottom to a depth of probably a hundred feet.

The deposits formed during this time, therefore, carry evidences of the culture of a long period of time. In this connection it is especially important to note that the artifacts of the lower beds are of a much more primitive type than are those in the upper layers. Not by any means all of the original deposits are exposed to inspection; the oldest and lowest beds are still covered and the highest ones have been destroyed; but a cross section of the intermediate members is open to inspection. As a consequence, of course, the earliest stages of the human history of the locality cannot be read here because the records are still buried; but the later steps are marked by finds still in place in successively higher and higher layers of deposits; and the very latest stages, which must have been recorded in overlying beds that are now destroyed, are mixed together in the jumble of residuary débris left from the selective erosion work of the wind. At such places these relics of the handiwork of prehistoric man may be found literally by the thousand.

This is the geologic situation at Shabarakh, and it is duplicated more or less fully, but usually very imperfectly, at many other places. When the conditions represented here are compared with those of the Altai range, where former alpine glaciation gives some clue to geologic age and structural relations, the following order of events seems to be established:

1ST STAGE.—Deep valley erosion during the last Glacial epoch whose influence was felt in central Asia. This process came to a halt with the advent of Recent climatic conditions. If we may accept the European estimates of time and assume that the last alpine glaciation in Asia corresponds to the last great ice advance in Europe and America, these climatic changes must have been introduced at least 25,000 years ago. They may indeed date back very much farther.

2D STAGE.—Establishment of Recent climatic conditions with change also from processes of valley erosion to those of deposition by rainwash in the valley bottom, covering relics of man's workmanship.



Fig. 3. The south margin of Shabarakh valley showing the red Cretaceous sandstone cliffs of the Djadokhta formation in the foreground and some of the Recent valley fill in the middle ground.

3D STAGE.—Gradual development of so great aridity that the processes were reversed and wind erosion was established on large enough scale to expose a considerable thickness of valley bottom deposits. During this stage the Dune Dwellers of Shabarakh disappeared.

4TH STAGE.—From that time to the present day many minor changes are recorded with epochs of deposition alternating with epochs of wind erosion. In the surface material many other evidences are recorded, including the cultures of all the races that have peopled and repeopled the Gobi region since it was abandoned by the Dune Dwellers of Shabarakh, who occupied it at the close of the Ice age.

ARCHÆOLOGY

By N. C. NELSON

The Gobi Desert probably never offered any outstanding material attractions to primitive man. Dependent as he was largely on the natural resources of his immediate surroundings, he could scarcely have ventured into the heart of a region so comparatively destitute of the bare necessities of life—edible plants and animals, water, fuel, and shelter—except perhaps for brief intervals during the most favorable seasons of the year, such as late summer and early fall. And at the best of times the adventurer could hardly have come empty-handed, not even during the Stone age; for the rock substances at all suitable for the production of tools and weapons were almost entirely lacking or were limited to a few pebbles of argillite, quartzite, and some rather brittle and intractable quartzes. The sparse native population of to-day, in spite of appearances, has in reality most of its wants supplied from the outside. Yet even so, our Expedition on occasion traveled as much as seventy-five miles across barren black waste without observing the slightest indication of human existence; and in this type of environment our own party, short of ammunition and the other contrivances with which our culture furnished us, would have quickly perished.

Nevertheless, leaving out of account for the moment the present mobile and partially self-sustaining Mongol inhabitants, we were not the first explorers to enter this great arid inland basin. Almost everywhere along the one thousand miles of the Expedition-route, from the Khingan mountains on the southeast to the outlying ranges of the Altai system on the northwest, we discovered more or less evident superficial traces of one or two prehistoric cultures; and once within sight of the Altai, not only did workable artifact materials, such as jasper, chalcedony, and agate, become in places very abundant, but the evidences of

long-standing occupation became gradually more and more apparent. The bulk of the archæological remains still lay scattered for the most part on the geologically ancient land surfaces, out of which they could not have weathered; but the types of things occurring were sufficiently differentiated to be distinguished as belonging to a succession of cultural horizons, some of which had ranged practically over the entire territory covered by the Expedition. Before long, however, we discovered, in no less than seven widely separated localities, the industrial remains of two of these horizons, more or less deeply imbedded in old stratified wind dépositions, as described by my colleague; and ultimately, at Shabarakh Usu, about seven hundred miles out on the route, we obtained these two closely related cultures in stratigraphic juxtaposition, proving beyond a doubt their time relationship and also their approximate antiquity.

In attempting now to differentiate and to characterize the archæological data found in Mongolia this season, I have no choice but to follow the European systems of classification and terminology, and in this place a mere inventory must suffice as to actual description. All told, we found traces, in the Gobi desert and its border regions, of six cultural horizons, five of which are of commonly recognized prehistoric date, as follows:

I. **EOLITHIC.**—This commencement stage—in which I personally take little stock—appears to be well represented in a number of places in Mongolia, especially in the region of Orok Nor. Here, on an old erosion surface, composed of Quaternary gravels, lie thousands of fractured boulders and pebbles, more or less weathered but showing successive stages of flaking. A large number of these splintered pieces assume artificial form and character, even to the extent of now and then showing the bulb of percussion. In addition, nearly all of them exhibit more or less retouched margins, a succession of chips having been removed much after the manner of true Mousterian technique. Yet the obviously varying ages of the chip beds leave no doubt that the specimens are the veritable product of natural forces still at work.

II. **UPPER PALEOLITHIC.**—Implements of this and earlier epochs were looked for in vain in the eastern and central portions of the Gobi, where, if present, they should have been visible on the surface, as no Pleistocene deposits were there identified. As it turned out, no positive traces were found except in the Orok Nor region, in fact on the same Quaternary plateau surface mentioned above in connection with the eoliths. There is this difference, however, between the occurrence of the eoliths and the paleoliths, viz., there is some reason for believing that

the latter may have weathered out of the gravel formation on which they rested; though none were actually removed from any appreciable depth. Another probable site is the high plain lying between Ulan Nor and the Artsa Bogdo mountains; but identification is here complicated by the fact that the region was a great source of raw material in later times, and thus our problem becomes one of distinguishing crude but finished implements of an early date from unfinished implements of a late date. The identifiable objects include:

1. Choppers or large scrapers of Mousterian type.
2. Oblong primitive flakes of Mousterian type.
3. Double end-scrapers of Aurignacian type, besides
4. A number of unfinished nondescript forms.

III. MESOLITHIC.—This stratum alone yields a combination of traits which, so far as known, may be termed distinctively Gobian. Moreover, its normal occurrence in old, dead, and indurated sand deposits, named by Messrs. Berkey and Morris the Shabarakh formation, is so striking and distinctive that we venture to designate it the Shabarakh culture. The stratigraphic position of this Shabarakh culture makes it positively pre-Neolithic; and the chipped stone (mostly red jasper) artifacts, by which alone it is known, in several specific details conform closely to the Azilian flint industry of western Europe. The inventory is as follows:

1. Hammerstones, mostly roundish adaptations. Scarce.
2. Cores, or nuclei, crude, multifaceted, angular, and spherical. Numerous.
3. Cores, or nuclei, slender, oblong, cylindrical to conical in outline with sometimes a sharp projection on one side adaptable for cutting purposes. Numerous.
4. Flakes, various forms, broad angular or subtriangular, with no retouch or indication of use; serviceable as knives, etc. Derived from Core No. 2. Very numerous.
5. Flakes, long, slender, prismatic, and often very delicate, with little or no retouch or sign of use; suitable as drills, graters, knives, etc. Derived from Core No. 3, by pressure process. Very numerous.
6. Perforators, produced by trimming or secondary chipping of flakes from either of the above groups. Rare.
7. Retouched flakes, various forms, of uncertain purpose but of use as knives or scrapers. Moderately numerous.
8. End-scrapers, small, mostly thumbnail size, round to oblong, some double-pointed, distinctly Azilian. Very numerous.
9. Disk beads of *Stenothoides* egg shell (occasionally dinosaur egg shell) in all stages of preparation, from rough angular fragments to drilled and ornamented examples. Finished forms scarce.

IV. NEOLITHIC.—This stage is an outgrowth, with modifications and additions, of the preceding Mesolithic. The two agree also, for the

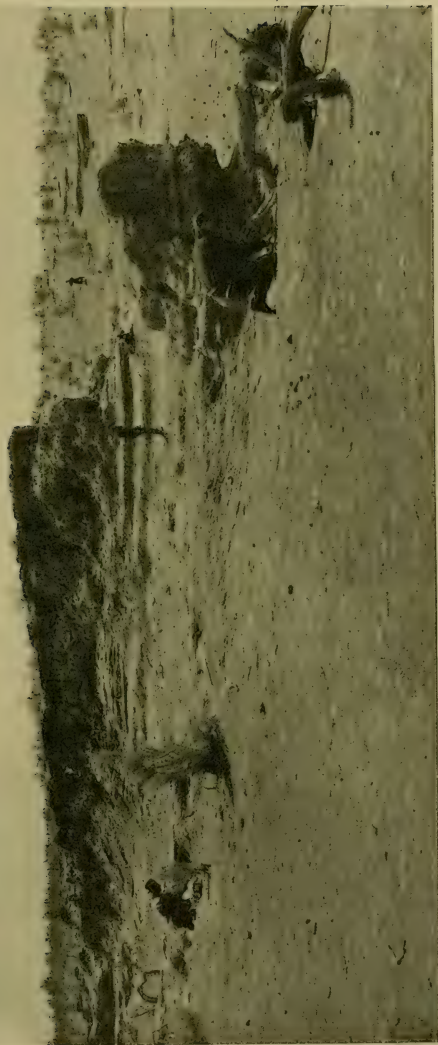


Fig. 4. The Shabarakh formation at Shabarakh Usu in the Djadokhta district.

This is the spot where the first artifacts were found in place. The light sandy sediments represent Recent valley fill due to change of climate from humid to arid conditions. These are now being removed by the work of the wind, leaving thousands of artifacts on the surface as residuary materials.

most part, in mode of occurrence; but the geographic range of the later Neolithic horizon would seem to be considerably greater. The outstanding traits include the following:

1. Hammerstones, ordinary, roundish. Scarce.
2. Grinding slabs of stone, thin, rubbed surface. Scarce.
3. Rubbing stones, flat, oval outline. Scarce.
4. Mortars, globular. Scarce and even doubtful.
5. Celts or axes, flaked surfaces with slight amount of polish near cutting edge. Scarce.
6. Adzes or gouges (perhaps scrapers with curving edge), chipped surface. Scarce.
7. Cores—as under III, 2. Numerous.
8. Cores—as under III, 3. Moderately numerous.
9. Flakes, ordinary—as under III, 4. Numerous.
10. Flakes, prismatic—as under III, 5. Moderately numerous.
11. Perforators—as under III, 6. Moderately numerous.
12. Worked or retouched flakes—as under III, 7. Moderately numerous.
13. End-scrapers—as under III, 8. Rather scarce.
14. Side-scrapers or choppers, elongated and disk-shaped. Moderately numerous.
15. Blanks or roughly flaked but unfinished implements. Moderately numerous.
16. Spear-points or knife-blades (mostly represented by fragments) of ordinary Neolithic form and finish, i. e., chipped in Solutrean style on both surfaces; more or less lanceolate, with straight, convex, or stemmed butt ends. Moderately numerous.
17. Arrow-points of small, often delicate, subtriangular outline, with straight, concave, convex, or stemmed butt ends. Rather scarce.
18. Potsherds, color gray to brick red; surface plain, string-marked, incised, or stamped with geometric patterns, some laid on or modeled decoration. Moderately plentiful.
19. Hearths, with the usual accompaniments of ashes, broken stone, bone, etc.

V. METALLIC.—This final, somewhat detached phase of the successive prehistoric developments in the Gobi is represented primarily by remains of distinctly monumental and pictorial characteristics. The "monuments" consist of rectangular and circular rock inclosures, ranging in dimensions from 3 to 150 feet across. Occupying the larger of these inclosures are cairns or conical rock-heaps of proportionately smaller diameters, but with heights varying from 3 to 8 feet. Actual investigation of several of each of the four types proved most of them to be or to have been burial places.

The pictorial feature, obviously associated with these graves, comprises a series of interesting pictographs, pecked on the face of the living rock, usually in the immediate vicinity of the tombs. Although uniformly crude in execution, these representations are easily recognized as of the realistic type, and include delineations of human beings, camels,

horses, and cattle, as well as of the stag, antelope, ibex, and mountain sheep—some of which game animals are now absent from certain of the localities under consideration. Perhaps the most suggestive figures, recurring in a number of widely separated places, are those of a man holding or leading a horse by a cord and of a man shooting with the bow and arrow. The legitimate inference seems to be that the people who raised these stone structures, or at any rate those who made the rock pictures, used the bow and arrow and that they had at least the horse domesticated.

For some time this strange combination of cultural traits constituted a puzzle. Petroglyphs of the type indicated usually belong to the Stone age; yet there were never any stone artifacts lying about near either the rock pictures or the burial structures. Also it was difficult to believe that man of the Stone age had had the horse domesticated. The only sane conclusion seemed to be that we were dealing with a culture based on wood and metal, like that of the present Mongol inhabitants. But the Mongols consistently denied all claim to both pictures and mounds. Sometimes they called the latter "bolosha," or treasure places, and admitted that they occasionally dug into them and found vessels and other objects of gold, etc. Our own efforts in this respect proved fruitless, however. We found skeletal remains of a brachycephalic people, but no artifacts whatever by which to date their culture. Not until the last week in the field, at a point barely 300 miles out on the route, did we open up a grave in which a number of normally perishable objects had been preserved. The list of accompaniments follows:

1. Wooden bowl of the type used by the present-day Mongols.
2. Saddle, neither Chinese nor Mongol in form but strangely like our McClellan.
3. Iron and leather (?) trimmings for saddle, almost completely decayed.
4. Quiver, of birch bark.
5. Bow, small, of compound type, made of three pieces of wood lashed together.
6. Arrows of solid wood and of reeds tipped with wood at both ends.
7. Arrowpoints of iron, mostly large, celt-shaped, with cutting edge forward. Badly corroded.
8. Textile fabrics, from body cover and also from turban-like headdress.
9. Animal bones, evidently remains of food placed with the corpse; etc., etc.

These meager data do not warrant any precise conclusions about this interesting culture. But some things are certain. The cairns marking its graves range over at least the larger portion of the Gobi, while the petroglyphs are found only in places where fine smooth rock exposures occur and therefore as a rule only in localities of at least moderate relief.

The more conspicuous rock tumuli are also naturally to be found in the mountainous districts, particularly in the piedmont regions of the Mongolian Altai. Strange to say, these remains give all the appearance of very considerable antiquity, yet must be of relatively recent date. For the culture is obviously not an outgrowth of the preceding localized Neolithic horizon of Shabarakh affinities, but is rather a foreign importation and probably an expansion of the remarkable mound culture of Bronze and Iron age times uncovered by Russian investigators in the Upper Yenisei country across the Altai. As such, its Mongolian antiquity can scarcely exceed 2000 years, and it may well have served to give character to the present Mongol culture.

VI. MONGOL.—It is only for the sake of a certain completeness that one ventures any remarks on the earlier stages of this surviving culture. The Mongol complex, whatever the date of its local beginnings, is presumably in no strict sense to be regarded as prehistoric. Moreover, its material traits were based so largely on perishable media that practically no important elements have been preserved. Even skeletal material is not available because the dead were seldom if ever interred, so that no cemeteries exist.

Certain sections of the Gobi landscape, to be sure, are dotted with dark brown spots, often marking long-abandoned winter camps. Semi-circular and sometimes rectangular corrals, made of heaped-up stones or brush, are not uncommon. Hearth-sites, represented by a few small boulders in close juxtaposition, are seen everywhere on the steppes. Small open shrines of stones laid in a rough circle and furnished with various magic-working paraphernalia occur in specially selected places. Natural cave-shrines, furnished sometimes a little more elaborately, are occasionally met with. And, outnumbering all other items, are the ever-present obos, ranging from small shapeless rock heaps to large and moderately well-formed structures. But all of these typically Mongol features, while doubtless of some antiquity and commonly in an advanced state of neglect or abandonment, are being reproduced at the present time and therefore have little that is new to tell about past times. The same is true of the old camp sites. Fragments of worked wood, antler, broken glazed crockery of Chinese manufacture, an occasional whetstone, etc., lie around. That is all. In the course of the season a single small cave was excavated, which proved to have been occupied for a brief period by the Mongols. But although the time of occupation may well have been quite distant, the few objects found were of strictly modern type. The archaeology of the Mongol culture in the Gobi is simply non-existent.

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SOME CHINESE FRESH-WATER FISHES¹

BY J. T. NICHOLS²

XVIII.—NEW SPECIES IN RECENT AND EARLIER FUKIEN COLLECTIONS

On his return to China Mr. Clifford H. Pope continued his work on fresh-water fishes and has sent in collections made in 1925 from three localities in the province of Fukien. These contain a new catfish and a new loach, described herewith, together with other forms which are apparently new in Mr. H. R. Caldwell's earlier collections from the same province.

Liobagrus anguillicauda, new species

DESCRIPTION OF TYPE.—No. 8474, American Museum of Natural History, from Chungan Hsien, northwest Fukien, June–July, 1925; collected by C. H. Pope.

Length to base of caudal, 75 mm. Depth in length, 5.3; head, 4.4. Eye in head, 9; snout, 2.8; maxillary, 2.4; interorbital, 2.5; maxillary barbel, 1.5; width of mouth, 1.8; greatest width (at back of head), 1.4; pectoral, 1.7; pectoral spine, 4; ventral, 2; dorsal spine, 4; longest dorsal ray, 2; longest anal ray, 1.4; space between dorsals, 1; caudal, 1.1.

Dorsal, I, 7; anal, 16.

Head depressed, flattish on top with a trough in the center, tail compressed; bones of head and nape deeply buried. Lips flaring, wrinkled; the upper jaw slightly the longer; eye superolateral, beneath the skin, placed over the end of the maxillary; maxillary barbel slightly shorter than the outer mental, which is situated immediately behind corner of mouth; the former, when laid back, does not reach gill-cleft by a distance greater than the diameter of the eye; gill openings wide, the membranes joining where they meet the isthmus. Dorsal origin slightly nearer snout than to tips of ventrals; ventrals placed well behind the dorsal; dorsal and pectoral spines small, smooth, sheathed in the skin of the fins; pectoral reaching $\frac{1}{2}$ the distance to ventral; ventral $\frac{2}{3}$ to anal; adipose low, a mere keel in front; confluent with pre-current caudal rays behind; caudal rounded, subtruncate. Body, and especially fins, with the exception of the caudal, covered with lax skin; lateral line not evident.

Purplish gray; paler below; the end of caudal somewhat darker, its margin pale.

We have several specimens of this species with the same data. It shows some individual variation, and variation with size, and is close to *L. nantoensis* Oshima from Formosa, than which it has a longer anal fin.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 68.

²Drawings of type specimens by Mrs. Louise Nash.

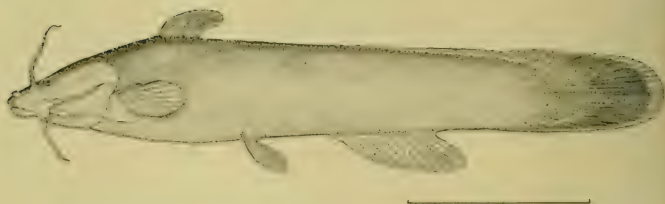


Fig. 1. *Liobagrus anguillicauda*, 75 mm. standard length.

Greater depth, longer dorsal, shorter anal, and color hold to differentiate it from *L. styani* Regan from South Hupeh; included lower jaw and longer dorsal differentiate it from *L. formosanus* Regan. Measurements of 4 specimens of *L. anguillicauda* give an idea of its variation as follows.

| Length (to base of caudal) | 85 mm. | 75 mm. (type) | 74 mm. | 72 mm. |
|-----------------------------|--------|---------------|--------|--------|
| Depth | 4.8 | 5.3 | 5.5 | 5.4 |
| Head | 5 | 4.4 | 4.4 | 4.4 |
| Width of head in its length | 1.1 | 1.4 | 1.2½ | 1.4 |
| Dorsal | I, 6 | I, 7 | I, 7 | I, 6½ |
| Anal | 16 | 16 | 16 | 16 |

***Crossostoma fascicauda*, new species**

DESCRIPTION OF TYPE.—No. 8475, American Museum of Natural History, from Fuching Hsien, Fukien, August–October, 1925; collected by C. H. Pope.

Length to base of caudal, 81 mm. Depth in length, 6; head, 4.1. Snout in head, 1.9; interorbital, 3; width of mouth, 3.6; distance mouth to snout, 5; chord of gill opening, 3.3; greatest width of body, 1.6; depth of peduncle, 2.2; its length, 2.1; pectoral, 1; ventral, 1.2; longest dorsal ray, 1.3; longest anal ray, 1.6; caudal, 1.1. Eye in snout, 3.8. Maxillary barbel in eye, 1; outer rostral barbel, 0.9; next longest rostral barbels, 1.4.

Dorsal, 11; anal, 8. Scales about 95.

Depressed anteriorly, head and snout notably so, compressed behind dorsal; lower surfaces flattened as far back as the ventrals; pectorals and ventrals in a horizontal plane; vent at $\frac{2}{3}$ the distance from ventral axil to anal origin. Top of head flattish; snout and cheeks sloping; eye superolateral, with a free rim; mouth transverse, well under the tip of snout, a thick fleshy lip or membrane overhanging the upper jaw; lower jaw rather firm; a small, doubly rounded flap, free in front, in the center of chin at the base of the lower jaw, and a minute barbel at either side of this flap; a fringe of 13 thickish, rather weak barbels around the edge of the snout before the mouth, separated by a trough from the membrane which overlaps the upper jaw; the two outer of these barbels decidedly longer than the others, about equal in size

to a (maxillary) barbel at the corner of mouth, which last has a minute nob or barbel beside its base on the inside; gill-membranes joined to lower surface below and before origin of pectoral. Dorsal origin equidistant from tip of snout and base of caudal, slightly in advance of ventral origin; pectoral extending $\frac{2}{3}$ the distance to ventral, ventral $\frac{3}{4}$ to anal; caudal slightly lunate, the lower angle the longer. Scales firm, with conspicuous concentric striae, absent from breast, except a linear-oval patch of small imbedded scales in its center; lateral line complete, straight, in the center.



Fig. 2. *Crossostoma fascicauda*, 81 mm. standard length.

Upper surfaces mostly dark, separated from an irregular dark lateral stripe (best marked posteriorly) by a pale line, which cuts across the back at the dorsal origin, and three times behind that fin, to separate off saddle-like blotches. A conspicuous small black mark in the axil of the ventral origin. Opercle crossed by vertical pale marks. Lower surfaces whitish. Front of dorsal with 3 dark bands; caudal crossed by 4 bold black bands; lower fins each with a vague dark touch.

This fish, of which there are several specimens, is not distantly related to the type of *Crossostoma*, *C. davidi*. From this it may be most conveniently separated by its shorter barbels and color. It is close or parallel to *C. gilberti* (Oshima), from Formosa, type of *Formosania*, Oshima 1919, and belongs in *Formosania*, a subgenus of *Crossostoma*. It is intermediate between *C. davidi* and the more specialized fish next to be described, probably also intermediate between *C. davidi* and certain members of the genus *Homaloptera*. The many barbelled *Crossostoma davidi* seems to be primitive, and *Homaloptera* as recognized by the writer at present is probably polyphyletic, but nominal genera into which it has been divided are probably based on degree of specialization rather than relationship.

***Crossostoma stigmata*, new species**

DESCRIPTION OF TYPE.—No. 8476, American Museum of Natural History, from Fukien; collected by H. R. Caldwell.

Length to base of caudal, 53 mm. Depth in length, 6; head, 4.5; Snout in head, 1.6; interorbital, 2.5; width of mouth, 3; width of gill-opening, 3.5; greatest width (the back of head), 1.3; depth of peduncle, 2.4; its length, 1.5; pectoral, 0.9; ventral, 1.1; longest dorsal ray, 1.2; longest anal ray, 1.3; caudal, 0.9. Eye in snout, 2.4. Maxillary barbel in eye, 2.5; longest rostral barbel, 1.6.

Dorsal, 10; anal, 8. Scales about 90.

Head strongly depressed, gently curving above, front outline of snout rounded; body somewhat compressed back of the ventrals; lower surfaces flat from snout to ventrals, pectorals and ventrals in a horizontal plane; vent equidistant from ventral axil and anal origin. Eye superolateral, with a slight free rim; mouth well under the



Fig. 3. *Crossostoma stigmata*, 53 mm. standard length.

snout, small, transverse, curved; snout with a fringe of 13 small barbels, somewhat irregular in size and in an uneven row; behind these a fleshy membrane or lip overhanging the upper jaw; lower lip represented by a slightly double-rounded flap, free in front a minute barbel at its base on either side; a small barbel at the tip of the maxillary; gill opening narrow, the membranes joined to side of breast below and in front of base of pectoral. Dorsal origin equidistant from tip of snout and tip of anal; pectoral extending $\frac{3}{4}$ the distance to ventral, ventral $\frac{3}{4}$ to anal; caudal sharply forked for $\frac{1}{4}$ of its length. Scales firm, strongly sculptured with concentric striae, absent on breast and on a narrow strip over pectoral to gill opening; lateral line complete, straight, in the center.

Lateral line pale, in a dusky streak; irregular bold dark blotches above and below it and on caudal lobes, those above and below not corresponding; fins with faint vague markings.

The type is our only specimen of this well-marked species, which is sufficiently close to the preceding (*C. fascicauda*) to be included with it in Oshima's subgenus *Formosania*.

***Pseudogobio fukiensis*, new species**

DESCRIPTION OF TYPE.—No. 8477, American Museum of Natural History, from Fukien province; collected by H. R. Caldwell.

Length to base of caudal, 49 mm. Depth in length, 4.9; head, 4. Eye in head, 3; snout, 2.6; interorbital, 3.5; maxillary, 2.6; width of mouth, 3.5; greatest width of body, 1.5; depth of peduncle, 2.5; its length, 1.7; pectoral, 1.; ventral, 1.3; dorsal broken; longest anal ray, 1.7; caudal broken. Barbel in eye, 1.5.

Dorsal, 10; anal, 8. Scales, 35. Teeth (in the single cotype), apparently one-rowed; 5, small, hooked, with a pronounced shoulder, on a short raised crest which stands out obliquely from the pharyngeal bone.

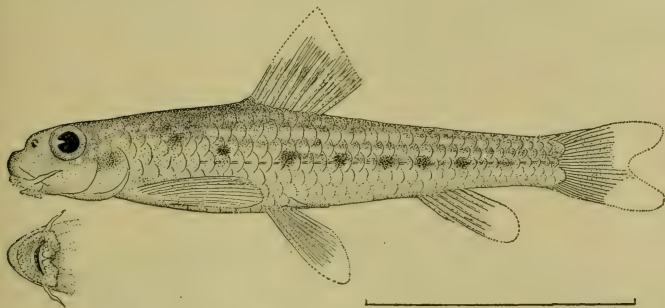


Fig. 4. *Pseudogobio fukiensis*, 49 mm. standard length.

Little compressed, flattened below anteriorly, head squarish; paired fins more or less in a horizontal plane; vent at about $\frac{1}{4}$ the distance from ventral axil to anal origin. Top of head flat; orbital rim raised so that interorbital is slightly concave; eye placed high, slightly superolateral; a dent between nostrils and snout; mouth inferior, curved protractile downward; with thick papillose lips, free behind on the lower jaw, flaring at the corners; 2 enlarged broad flat papillæ at the chin, and 2 less enlarged ones corresponding to them on the upper lip; gill membranes joined to isthmus beneath the flap of the opercle, about under the edge of the preopercle. Dorsal and anal without spines; dorsal origin very slightly nearer anal axil than to end of snout; ventral origin under first third of dorsal base; pectoral reaching ventral origin; ventral $\frac{2}{3}$ to anal. Scales with close-spaced radiating striæ; breast without scales; lateral line complete, straight in the center, rising slightly at its front end.

About 7 small dark spots along middle of side, and 2 faint, broken lengthwise streaks indicated above them; fins plain.

Apparently a representative form of *P. chinssuensis* from Shansi and *P. tungtingensis* from Hunan, from which it differs in fewer scales, and other particulars.

***Opsariichthys minutus*, new species**

DESCRIPTION OF TYPE.—No. 8478, American Museum of Natural History, from Fukien province, collected by H. R. Caldwell.

Length to base of caudal, 37 mm. Depth in length, 3.5; head, 3.3. Eye in head, 3.6; snout, 3.4; interorbital, 2.8; maxillary, 2.5; width of body, 2; depth of peduncle, 2.5; its length, 2; fins broken.

Dorsal, $9\frac{1}{2}$; anal, $10\frac{1}{2}$; Scales, 45 (3 between lateral line and ventral; 9 rows between lateral line and dorsal).

Compressed, breast and belly rounded, vent immediately before anal origin. Head pointed, interorbital slightly convex; lower jaw slightly projecting; maxillary somewhat oblique, to under front of pupil; the 2 jaws interlocking along an S-shaped curve precisely as in *Opsariichthys bidens*, but less pronouncedly so; gill membranes joined to center of isthmus under hind margin of pupil. Dorsal and anal without spinous rays; dorsal origin equidistant from base of caudal and front of eye, over that of the ventrals; pectoral placed low. Lateral line complete, sloping down over the pectoral and running low, sloping up on the peduncle to run in its center for the last few scales.

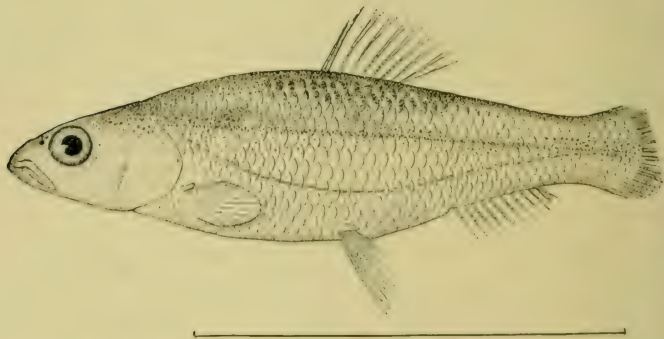


Fig. 5. *Opsariichthys minutus*, 37 mm. standard length.

Nape, and a streak from nape to dorsal dark; a fine dark streak in the center of the peduncular region; otherwise mostly pale.

Based on two small imperfect specimens, which would appear to be approximately adult. In its technical characters this little fish is like the larger predaceous species of *Opsariichthys*, from which it differs in greater depth and smaller size. It may be considered a dwarf form of that genus, or perhaps a primitive form if one assumes that *Opsariichthys* was developed from Rasbora-like fishes which run small.

***Parapelecus fukiensis*, new species**

DESCRIPTION OF TYPE.—No. 8479, American Museum of Natural History, from Fukien province; collected by H. R. Caldwell.

Length to base of caudal, 95 mm. Depth, 4.6; head, 4.4; Pectoral as long as head; lower jaw slightly included; dorsal origin equidistant from margin of gill-cover and base of caudal.

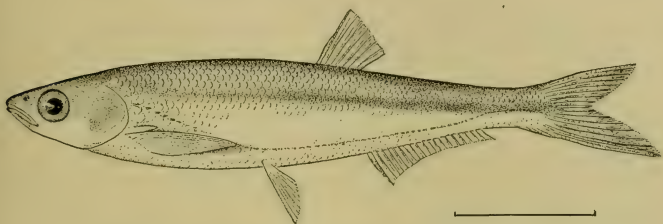


Fig. 6. *Parapelecus fukiensis*, 95 mm. standard length.

Close to *P. argenteus* Günther from Kiangsi and to *P. nicholsi* (Fowler) from Anhwei, but anal shorter, of 21 rays (versus 25). Scales (largely lacking) estimated as 65; teeth 3-rowed, 5, 3, 2.

P. machaerius Abbott from Chihli has a still longer anal (29). All may be races of one species. *P. fukiensis* is based on a single specimen not in very good state of preservation.

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CRETACEOUS MAMMAL SKULLS FROM MONGOLIA¹

BY WILLIAM K. GREGORY AND G. G. SIMPSON

The discovery of Cretaceous mammal skulls in Mongolia by the Central Asiatic Expedition of the American Museum of Natural History is an event of exceptional importance in vertebrate palæontology. The Cretaceous forerunners of the varied placental mammals of the Paleocene and Eocene have hitherto been known only by inference. The studies of Cope, Osborn, Wortman, Matthew and others upon the dentition and skeleton of Eocene mammals led to the view that the earliest insectivores and creodonts, taken collectively, were descendants of the most primitive group of placentals, for which the name Therictioidea was proposed by Gregory in 1910.² It was further inferred that the stem placentals of the Cretaceous would be more or less intermediate in character between the Jurassic *Amphitherium* and such early Eocene forms as *Palæoryctes*, *Didelphodus* and the *Oxylænidæ*.³

In 1924 and 1925, the Third Asiatic Expedition, under the leadership of Roy C. Andrews, explored the Djadokhta formation of Mongolia, which yielded the famous dinosaur eggs and the superb series of *Protoceratops* skulls and skeletons. Here Mr. Walter Granger and his associates after prolonged search finally discovered no fewer than seven skulls or parts of skulls, some with associated lower jaws, of Cretaceous mammals. Of these the first specimen discovered in 1924 proved to be an allotherian or multituberculate and has been described as the type of a new genus and family of allotherians in the American Museum Novitates.⁴

The remaining specimens discovered in 1925 have been very skillfully extricated from the matrix by Mr. Albert Thomson and generously entrusted to us for description by Professor Osborn and Doctor Matthew. Upon examination the new specimens appear to be quite distinct from all of the hitherto described jaws and teeth of Cretaceous mammals, including those in the Marsh collection of the Peabody Museum, Yale University, in the American Museum of Natural History, in the U. S. National Museum and elsewhere.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 69.

²The Orders of Mammals, Bull. Amer. Mus. Nat. Hist., XXVII, p. 464; see also pp. 304-307, 467, 468.

³1922, The Origin and Evolution of the Human Dentition, Baltimore, pp. 99-107, 512.

⁴Simpson, George Gaylord, 1925, A Mesozoic Mammal Skull from Mongolia, American Museum Novitates, No. 201, Nov. 24.

At least the majority of the known American Cretaceous mammals, except the allotherians, are marsupials, related rather closely to the existing opossums. All the Mongolian Cretaceous mammals, on the contrary, again excepting the allotherians, so far appear to be placentals.

As far back as Morrison (uppermost Jurassic) times the pantotherian mammals were differentiated into several families. We are also not surprised to find that the Mongolian Cretaceous placentals show considerable diversity among themselves, so that even in the half dozen specimens now available there are representatives of not less than four genera and two families, all apparently new to science.

The largest of these animals was somewhat bigger than a large house rat. Its skull and dentition were distinctly carnivorous in type, with enlarged laniary canines and sharp-bladed, narrow triangular molars, approaching in these features the most primitive Eocene creodonts. Three genera are referred to this family, which is named by us the *Deltatheriidae*. The upper molar teeth are in what may be called a pretritubercular stage of evolution, since the para- and metacones are connate or not separated from each other and are median in position, in line with the primitive tips of the premolars, while the so-called "protocones" are internal spurs from the base of the crown. The lower molars are tritubercular, with shearing paraconid-protoconid blades and narrow heels.

In the second family, called *Zalambdalestidae*, the very elongate snout suggests that of *Solenodon*, except that the lateral, not the median, incisors are enlarged. The cheek teeth, much worn in the type, strongly suggest those of zalambdodont insectivores, but a referred specimen indicates that the para- and metacones were partly separated and more buccal in position than in modern zalambdodonts, thus supporting Mivart's and Matthew's view¹ that the peculiar zalambdodont molars have been derived from a more normal tritubercular type. The lower molars are tuberculo-sectorial, with fairly broad heels. One pair of the anterior teeth, probably the median incisors, were much enlarged and procumbent, working between the enlarged upper incisors. The canines were small or absent and there were long spaces behind the enlarged front teeth. The skull avoids the specializations of modern zalambdodonts, the nasals being separate, the zygomatic arches complete and the glenoids not displaced medially; orbital region less reduced, with prominent lacrymal rims. Braincase moderately expanded, not tubular. In these and other important details the *Zalambdalestidae* agreed with the

¹Matthew, W. D., 1913, A Zalambdodont Insectivore from the Basal Eocene, Bull. Amer. Mus. Nat. Hist., XXXII, Art. 27, pp. 307-311.

Deltatheridiidæ, and the characters of one of the new genera named *Hyotheridium* may indicate that at that time the two families were still closely related, however much their presumed descendants, the placental carnivores and insectivores, diverged in later times.

Accordingly these specimens afford additional support for the following conclusions, based on much other evidence:

1) The Paleocene and Eocene insectivores and oxyclænid creodonts, taken collectively, represent survivors of an earlier insectivore-creodont stock, examples of which have now been discovered in Mongolia.

2) The discovery of these earliest of definite placentals in Mongolia furnishes some support to the hypothesis that Central Asia was the homeland of the placental radiation.

3) The Mongolian Cretaceous mammals stand between the Jurassic pantotherians and the Paleocene placentals, both in time and in dental structure, but are somewhat nearer to the latter.

4) The Mongolian Cretaceous mammals favor the view of Wortman and others that the para- and metacones collectively of the mammalian tritubercular molar are in line with, and homologous with, the "reptilian" tip of the premolar crowns, and that the so-called protocones represent internal basal spurs, correlated functionally with the differentiation of a heel or talonid, on the lower molars.

The following is a list of the mammalian fauna now known from the Djadokhta formation:

MULTITUBERCULATA

Ptilodontidæ

Djadochtatherium matthewi Simpson

INSECTIVORA

Deltatheridiidæ

Deltatheridium pretrituberculare G. and S.

Deltatheroides cretacicus G. and S.

Hyotheridium dobsoni G. and S.

Zalambdalestidæ

Zalambdalestes lechei G. and S.

Of these, all are known from at least part of the skull, including the palate, and all but *Deltatheroides* also from associated lower jaws. *Zalambdalestes* is incomparably the best known of all Mesozoic mammals, every main part of the skull and jaws being known, although some features are still rather obscure.

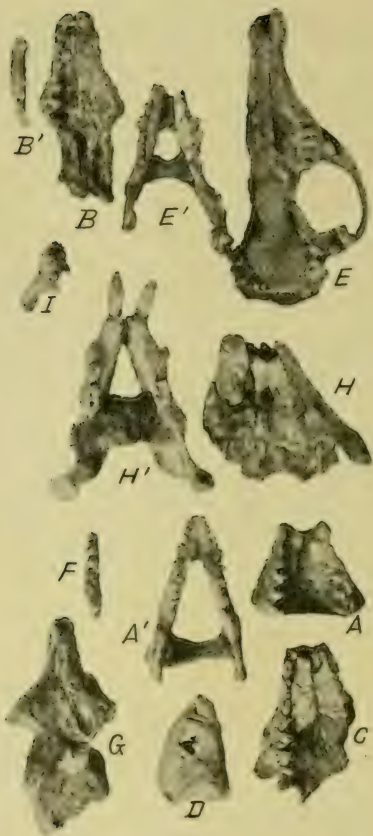


Fig. 1. Cretaceous mammal skulls and jaws. Djadokhta formation, Mongolia. Natural size.

- A, A', *Deltatheridium pretrituberculare*. Type.
- B, B', *Deltatheridium pretrituberculare*. Referred specimen, A. M. No. 21706.
- C, *Deltatheroides cretaceus*. Type.
- D, *Hyoatheridium dohsoni*. Type.
- E, E', *Zalambdalestes lechei*. Type.
- F, *Zalambdalestes lechei*. First paratype, A. M. No. 21707.
- G, *Zalambdalestes lechei*. Second paratype, A. M. No. 21701.
- H, *Djadochtherium matthewi*. Type.
- I, *Djadochtherium matthewi*. Referred specimen, A. M. No. 21703.



Fig. 2



A.M. 21705

Fig. 3

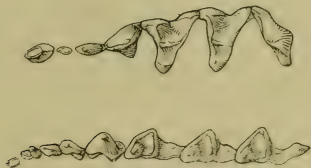


Fig. 4

Fig. 2. *Deltatheridium pretrituberculare*. Type, A. M. No. 21705. $\times \frac{3}{4}$.

Fig. 3. *Deltatheridium pretrituberculare*. Type palate. $\times \frac{2}{3}$.

Fig. 4. *Deltatheridium pretrituberculare*. Left upper and right lower teeth of type. $\times \frac{3}{4}$.

The photographs are by Mr. Albert Thomson, the drawings by Mrs. Helen Ziska.

Deltatheridiidæ, new family

DEFINITION.—Upper molars pretritubercular, trenchant, pa and me barely if at all separated or very closely approximated and medial in position; no hy.; interdental embrasures widely open on lingual side. P^1 not molariform, but may have an internal basal expansion. Last premolars, above and below, more or less trenchant and elevated. Canines enlarged, laniary. Lower molars of primitive tuberculo-sectorial type, the paraconids high, the heels narrow. Known features of skull of primitive insectivore-creodont type. Braincase moderately expanded, not tubular.

To this family are referred *Deltatheridium*, *Deltatheroides*, and doubtfully *Hyotheridium*. Although the known members of the group show slight generic specializations, such as the absence of P^1 in *Deltatheridium*, there is nothing in their more general features to exclude the family from a very central phylogenetic position, ancestral to the creodonts and to many or all of the dilambdodont insectivores and possibly also to other orders. *Didelphodus* of the Wasatch may be related to this family, but it is somewhat more progressive in the further separation of the pa and me and the greater width of the talonids.

Deltatheridium pretrituberculare, new genus and species

TYPE.—Amer. Mus. No. 21705. Palate with C-M³ and associated lower jaws (Figs. 1-3).

HORIZON.—Djadokhta formation, Upper Cretaceous.

LOCALITY.—Shabarakh Usu, Mongolia.

GENERIC CHARACTERS.—DENTAL FORMULA $I_2^2 C_1^1 P_3^3 M_3^3$. P^1 missing, P^2 simple, one-rooted, P^3 shorter than P^1 . P^1 transversely compressed but with small lower posterointernal heel. M^2 transversely widened. No diastemata back of the canine. Lower molars with pr'd higher than pa'd and latter higher than me'd. Talonid comparable in length to trigonid but narrower and more on internal side of tooth. M_3 not reduced, talonid elongated. Snout robust, postorbital constriction slight.

DEFINITION.—The dental characters are quite clearly shown on the type specimen. M^3 is a short transverse tooth, strongly oblique anteroexternally. The metastyle and its spur are reduced; the parastylar spur is enlarged and extends strongly anteroexternally. The pa and me do not seem to be separated. On M^2 the pa and me are as yet unseparated or closely approximated, and have a single undivided base. They are quite precisely median on the tooth. Ps and ms are distinct, the former distinctly larger. The pr is heel-like, much lower than pa-me, and lower than the parastyle. This is the widest of the three molars, in contour lambdoid, with the ps hooked forward and with a deep median notch in the external border.

The basal section is acutely triangular, the rounded apex internal and supporting the protocone, the posterior, or metastyle side being a little longer than the anterior, or parastyle side. Apparently there were three roots at the angles of the triangle.

M¹ is comparable in structure, but narrower (transversely), with mts large, relative to ps, and the connate pa and me relatively nearer the external border. P¹ has a high compressed external cusp, apparently with a lower posterior accessory cusp. The tooth is not molariform, but the beginning of such a tendency is seen in the presence of a low posterointernal basal swelling. The main cusp is much higher than that of the succeeding teeth. P³ is a smaller, single, two-rooted, transversely compressed

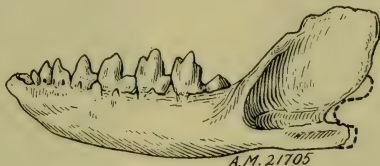


Fig. 5. *Deltatheridium pretrituberculare*. Lower jaw of type. $\times \frac{2}{1}$.

tooth, while P² is still smaller, one-rooted, and P¹ is lacking. The upper canine is a very large, one-rooted, strongly compressed tooth, and, as is seen in No. 21706 (see below), is preceded by a diastema in which is developed a deep pit for the reception of the similarly enlarged lower canine.

In the associated lower jaw (Fig. 5) M₃ is not reduced, its trigonid wider than that of M₂ but not so long relatively. The talonid is much elongated and very narrow.

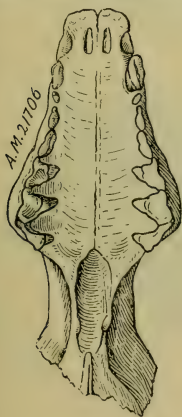


Fig. 6. *Deltatheridium pretrituberculare*. Referred specimen. $\times \frac{2}{1}$.

Its cusp structure is obscure, while that of the trigonid seems to be as in M₂. The latter is of primitive tuberculo-sectorial type, the three trigonid cusps distinct, sharply pointed, and erect. The pr'd is higher than the pa'd and the latter is higher than the me'd. The talonid is a little shorter than the trigonid and is narrow and does not extend so far externally as the trigonid. Its cusps have been worn off. M₁ is similar to M₂, save that the trigonid is a little narrower. P₁ is not at all molariform, but is a



Fig. 7. *Dellatheridium pretrituberculare*. Referred specimen. $\times \frac{3}{4}$.

high, two-rooted, compressed tooth with a single main cusp and a small median posterior heel cusp. P_3 is similar but much smaller, lower, and pointed rather more forward, while P_2 is still smaller but also two-rooted. P_1 is absent. The canine is large, semiprocumbent, and there are no pre- or post-canine diastemata. The number of incisors is questionable, but they were arranged in a transverse arc.

SKULL AND JAWS.—The skull of the type is not preserved, but another specimen, Amer. Mus. No. 21706, agreeing very closely in dental character with the type and referred to the same genus and species, consists of a well-preserved anterior half of the skull, with an associated fragment of the lower jaw. The skull was apparently quite stout, with a robust and not greatly produced snout. The interorbital expansion and postorbital constriction are not marked. The orbit is of primitive character and moderate size, with a somewhat projecting lacrymal rim, the lacrymal foramen marginal. The nasals are separate, long, widening posteriorly and slightly constricted in the middle. The premaxillæ are essentially as in *Didelphis*, save that the postero-ascending process does not extend so far posteriorly. Also as in *Didelphis*, a thin plate from the maxilla covers the precanine pit externally so that the suture is anterior



Fig. 8. *Deltatheridium pretrituberculare*. Restoration based on referred skull. $\times \frac{1}{2}$. 2

to the latter, as seen from the side. The sagittal crest is, so far as may be inferred from its anterior portion, of slight development. The palate is of comparable width, internal to the alveoli throughout, and is without fenestræ. The interpterygoid channel is long and narrow.

For the characters of the mandible we turn again to the type (Figs. 2, 5). The jaw in general is quite heavy and relatively short. The lower border is broadly curved, turning up rather markedly anteriorly. The symphysis is short, ending beneath P_3 . The coronoid was broad and stout. The posterior ends of both rami are broken off so that the nature of the condyle and angle cannot be inferred, but there is no evidence that the latter was inflected.

MEASUREMENTS

A. Type

| | | |
|---|------|-----|
| Upper cheek teeth (ant. face canine to post. face M^3) | 15 | mm. |
| P^{2-4} ant. post. | 4.8 | |
| M^{1-3} ant. post. (along median cusps) | 6.3 | |
| Lower cheek teeth (c to m_3) | 17 | |
| P^{2-4} a.p. | 5.3 | |
| M^{1-3} a.p. | 10.2 | |

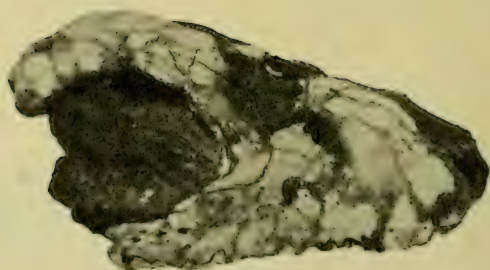


Fig. 9



Fig. 10

Fig. 9. *Deltatheroides cretaceus*. Type, A. M. No. 21700. $\times \frac{3}{4}$.

Fig. 10. *Deltatheroides cretaceus*. Upper teeth of type, much worn and broken. $\times \frac{3}{4}$.

B. Referred specimen (No. 21706)

| | |
|--|------|
| Upper cheek teeth (ant. face C to post. face M ³)..... | 14.5 |
| P ²⁻⁴ a.p..... | 4.9 |
| M ¹⁻³ a.p..... | 6.1 |
| Tip pmx. to glenoid fossa..... | 30.2 |
| Tip pmx. to lacr. tubercle..... | 14.2 |
| Width across upper canines..... | 7.1 |
| Width across M ³ (outside)..... | 12 |
| Length of palate, tip pmx. to post. nares..... | 20 |
| Width of skull across lacr. tubercles..... | 12.5 |
| Width across incipient post. orb. processes..... | 8 |

Deltatheroides cretacicus, new genus and species

TYPE.—Amer. Mus. No. 21700, anterior part of skull with C-M³, badly worn and broken (Fig. 5).

HORIZON.—Djadokhta formation.

LOCALITY.—Shabarakh Usu, Mongolia.

GENERIC CHARACTERS.—Apparently closely similar to *Deltatheridium* in the comparable features, but slightly more robust, with four upper premolars, the first one-rooted, P² two-rooted, P³ about as long as P⁴, and the latter with a more marked internal expansion (submolariform).

This imperfectly known genus, the molars of which are so badly worn as to make their structure somewhat doubtful, must be closely related to *Deltatheridium*, with which it agrees closely in general form, tooth arrangement, and molar pattern so far as can be told. The total length of the upper molars is also the same. The differences in the premolars, however, appear to be such as could not be ascribed to age or to individual or specific differences, and probably the other features will be found to furnish valuable distinctions also when they are better known.

MEASUREMENTS

| | |
|---|----------|
| Upper cheek teeth (ant. face canine to post. face M ³)..... | 18.1 mm. |
| P ¹⁻⁴ a.p..... | 8.2 |
| M ¹⁻³ a.p..... | 6.3 |

Hyotheridium dobsoni,¹ new genus and species

TYPE.—Amer. Mus. No. 21702, complete anterior portion of interlocked skull and jaws, broken off just back of M³₂.

HORIZON.—Djadokhta formation.

LOCALITY.—Shabarakh Usu, Mongolia.

GENERIC CHARACTERS.—Dental formula I²₁ C¹₁ P³₂ M³₂. Diastemata between C and P²₂ and beneath P²₂ and P³₂. Canines large, first premolars wanting. Ant-orbital constriction of skull pronounced, snout slender and moderately elongated.

¹In honor of the author of "A Monograph on the Insectivora."

Due to the fact that it has not been possible to separate the interlocked jaws and that the teeth are worn and obscure, their structure is very doubtful. It seems probable that it was comparable to that of *Deltatheridium*. There is a small transverse M^3 , larger $M2-1$, perhaps a submolariform P^4 , and two-rooted, compressed P^5 , both higher than the molars. In the middle of the post-canine diastema is the smaller



Fig. 11. *Hypotheridium dobsoni*. Type, A. M. No. 21702. $\times \frac{3}{4}$.

two-rooted, compressed P^2 . Anterior to the large upper canine is a diastema and notch for the lower one. The lower dentition was of the same arrangement: three molars, two higher but undoubtedly simple premolars, one premolar a little anterior to the middle of the long post-canine diastema.

The slender elongated snout is very distinctive in comparison with *Deltatheridium*. There appears to be a good naso-lacrimal contact, excluding a fronto-maxillary one.

The molar structure is very dubious but it seems more reasonable that it was more similar to that of *Deltatheridium* than to that of *Zalambdalestes*. In general aspect, elongation of face, development of diastemata, etc., No. 21702 is certainly intermediate between the two but it is not safe to assume that it forms an actual structural link, since its more significant structural details are too obscure for final judgment.

As nearly as one can judge there was a short ("transverse") M^3 , two large and typical molars in front of this (M^{1-2}), a probably submolariform P^4 , and a compressed,

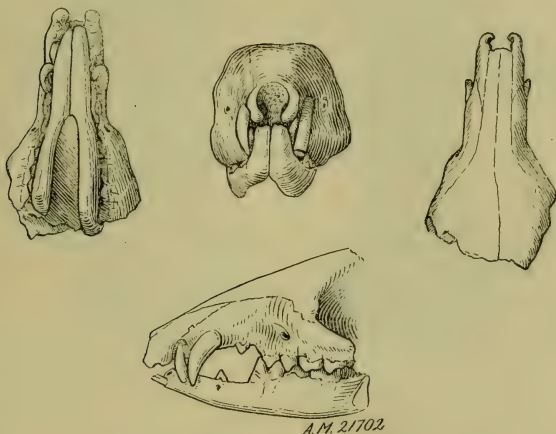


Fig. 12. *Hyotheridium dobsoni*. Type. $\times \frac{3}{4}$.

two-rooted P^3 . Then is developed a short diastema, then a smaller, compressed, two-rooted P^2 . P^1 is lacking, in its place there being another very slightly larger diastema. The large trenchant tooth in front of this is very clearly the C, not an I as in *Zalambdalestes*. It is preceded by a notch for the similarly enlarged lower canine.

MEASUREMENTS

| | | |
|--|------|-----|
| Upper cheek teeth (ant. face canine to post. face M^3)..... | 14 | mm. |
| M^{1-3} a.p..... | 4.3 | |
| Tip pmx. to lac. tubercle..... | 13.3 | |
| Width across upper canines..... | 4.5 | |
| Width across M^3 (outside)..... | 7.3 | |
| Width of skull across lac. tubercles..... | 9.8 | |

Zalambdalestidæ, new family

DEFINITION.—Upper molars with distinct but closely approximated paracone and metacone, sublateral in position. Protocone low but well developed. No hypcone. Molars crowded antero-posteriorly, the interdental embrasures reduced to narrow fissures. P^1 more or less molariform. Lower molars with three distinct trigonid cusps but with the pa'd lower than the me'd. Talonids still large, basined, with distinct entoconids and hypoconids, occluding with the protocone only. Orbit and antorbital region of primitive type. Nasals separate. Zygomata complete. Glenoid little displaced internally.

Although a great morphological gap lies between the family thus defined and those to which the recent zalambdodonts are referred, the characters mentioned in the definition are believed without exception to be such as would be seen in the common ancestor of the latter. The Zalambdalestidæ are regarded as representing the stem group of the zalambdodont stock possibly at a time before it separated from the leptictid branch. There are many resemblances with the leptictids in the skull and cheek teeth.

Zalambdalestes lechei,¹ new genus and species

TYPE.—Amer. Mus. No. 21708 (Fig. 7).

PARATYPES.—Amer. Mus. Nos. 21707 and 21704.

GENERIC CHARACTERS.—Dental formula $I^2 \frac{2}{3} C^0_1$ or $1^1 P^3_3$ or 2^1 . Apparent second upper incisors much enlarged, long post-canine diastema with two-rooted tooth in center of it. M^2 reduced. Anterior lower incisor procumbent, enlarged. Lower canine incisiform. Molars with trigonids narrower than talonids, with pr'd about equal to me'd and both markedly larger than the reduced pa'd. Talonid of M_3 with three distinct cusps, hy'd slightly lower than the approximated en'd and hl'd. Talonid of M_2 not elongated. Snout long, tubular, bent somewhat downward. Sagittal and lambdoid crests moderately developed. Zygomata expanded.

DENTITION.—The upper molars are seen in crown view only in the holotype. They are three in number, the last reduced and with anteroexternal extension, and are unusually short and broad. The outer contour of each is slightly concave in the middle. The cusp structure is obscure, save that there is a marked protocone heel. No. 21704 appears to be a younger individual than the very old type. It apparently retains the deciduous anterior teeth and its snout is much shorter than that of the senile type. It has all its permanent molars in place, and although they cannot be seen in crown view it is possible to affirm that on at least M^{1-2} the pa and me are distinct, although closely approximated and with connate bases, sublateral or nearly so. Returning to the type, P^1 is molariform but with the pa and me nearer the external border. M^1 is the widest of the series. P^3 is not molariform although displaying all the homologous cusps. It is triangular with a high external cusp, a smaller posteroexternal accessory cusp, and a lower internal protocone spur. Apparently

¹In honor of Professor Wilhelm Leche, author of valued memoirs on the zalambdodonts and other insectivores.



Fig. 13. *Zalambdalestes lechei*. Type. $\times \frac{2}{1}$.

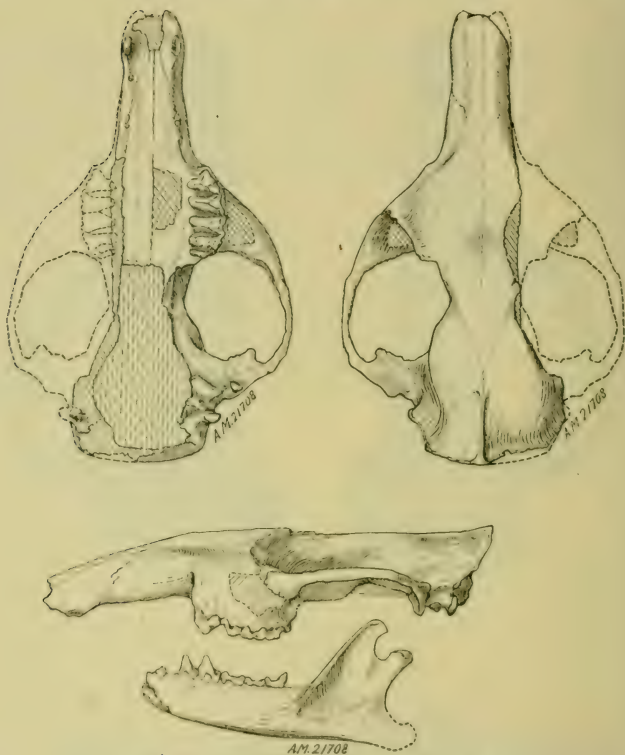


Fig. 14. *Zalambdalestes lechei*. Type. $\times \frac{3}{4}$.

there was also a small anteroexternal styler cusp. Anterior to this tooth is a long diastema, in the middle of which are the two roots of a moderate-sized, compressed, trenchant tooth. The homologies of this tooth are uncertain. It corresponds closely to P^2 of recent zalambdodonts but occludes anterior to the apparent second lower premolar. In front of the premaxillo-maxillary suture is a large transversely compressed, apparently caniniform second incisor. These incisors are not terminal and are separated by the width of the narrow palate. Apparently they were preceded by diastemata, but the tip of the palate is broken.

The lower molars are too worn on the type to be of great value, but are quite clearly seen on No. 21707, referred to the same species. M_2 is reduced, shorter and

narrower than M_2 , with the heel not elongated. There are three heel cusps, a rather small hy'd and the closely approximated and somewhat higher en'd and hl'd. The heel is slightly broader than the trigonid and is basined. M_{1-2} are large but closely similar. The protoconid is little if any higher than the metaconid, while the paraconid is reduced. The low hypoconids project laterally; the entoconids are high. P_4 is molariform, similar to M_1 but higher and with a much shorter talonid and relatively elongated trigonid. The pr'd definitely but slightly overtops the me'd, while the pa'd, as before, is small. P_4 is trenchant, two-rooted, consisting of a single cusp with a small unbasined heel; it is nearly as high as P^4 .

Neither No. 21707 nor the type shows the anterior region of the lower jaw, but it is well seen in lateral view in the younger skull No. 21704.



Fig. 15. *Zalambdalestes lechei*. Lower teeth, occlusal, outer and inner views. $\times \frac{3}{4}$.

P_2 is much smaller than P_3 and more procumbent. In front of it are three one-rooted teeth of increasing procumbency, all simply styliform. The posterior of these must be the canine, the other two I_{2-3} . I_1 is much enlarged, procumbent, and occludes between the enlarged upper incisors.

SKULL.—The palate is a featureless, greatly crushed plate of bone without fenestræ and apparently with no postpalatal ridge. It is somewhat widened in the molar region, but narrower anteriorly and of nearly equal width for the entire length of the snout. The choanæ are narrower than the molar region of the palate. The sutures of the palate are open, although the individual is certainly an old one.

The internasal suture is also open, a remarkable feature for a zalambdodont, but the naso-frontal suture seems to be closed or unrecognizable (the region is somewhat crushed). The premaxilla is much elongated, its posterosuperior point being above P^2 . The zygoma arises opposite P^1 - M^2 . The large opening in its base seen in the photographs is entirely post-mortem in origin and occupies the place of a broad, flat, thin plate of bone for the attachment of the powerful snout muscles. The true infra-orbital foramen is small, near the alveolar border, at the anterior constriction of the

skull just in front of P^3 . The lacrymal rim is much elevated and sharp, the lacrymal foramen inside the rim.

The glenoid region is quite centetoid in aspect. The so-called fossa itself is a broad flat horizontal plate, passing externally into the zygoma, and internally having a thin, long, horizontal root on the squamous portion of the squamosal. There is a very distinct, abrupt, vertical, styliform entoglenoid process, posterointernal to the articular surface for the mandibular condyle. The glenoid is external to a line continuing the molar axis, as in a few modern zalambdodonts, but is distinctly more external relative to the occiput than in the latter, in which it has been displaced inward. There is a crest curving inward and forward from the entoglenoid, and, although the alisphenoid region is broken on the type, it can be seen on No. 21704 to be continuous with the pterygoid plate. The lower end of the lambdoid crest forms a

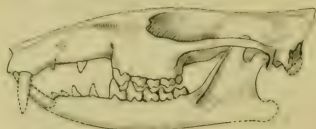


Fig. 16

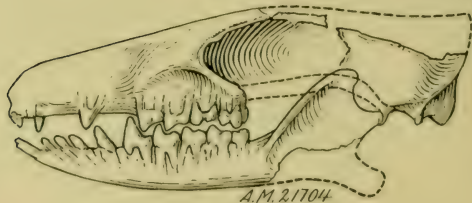


Fig. 17

Fig. 16. *Zalambdalestes lechei*. Restoration based chiefly on type. $\times \frac{1}{4}$.

Fig. 17. *Zalambdalestes lechei*. Paratype, slightly restored. $\times \frac{1}{4}$.

small prominence just above the post-tympanic process and separated from the latter by a notch. Between these two processes posteriorly and the entoglenoid process anteriorly is a rather large open semicircular groove for the auditory meatus. From its course it appears that the middle ear was internal to the entoglenoid rather than posterior as in recent zalambdodonts.

LOWER JAW.—The coronoid ascends at a little distance back of M_3 at ca. 45° to the alveolar border. Its apex is high but rather small and recurved. The condyle is markedly above the alveolar level, the articular surface relatively large and superior in position. The angle is not preserved. There is no masseteric crest, but the fossa is delimited anteriorly by a rounded swelling, which rises, becoming sharper, and borders the coronoid anteroexternally. The internal posterior surface of the mandible is almost featureless, save for the faint oblique swelling running posteriorly to support the condyle and the shallow concavities above and below this.



Fig. 18. *Zalambdalestes lechei*. Paratype, A. M. No. 21704. $\times \frac{3}{1}$.

Measurements

| | Type A. M. 21708 | Paratype A. M. 21704 |
|---|---------------------|-------------------------|
| Length pmx.-mx. suture to post. border M ³ | 19.7 | 19.8 |
| P ₃₋₄ a.p. (ectoloph)..... | 5 | 4.8 |
| M ₁₋₃ (median)..... | 4.3 | |
| M ¹ a.p. (ectoloph)..... | 1.2 | 1.3 |
| M ¹ (transverse)..... | 3.1 | |
| Length skull pmx.-cond. (estim.)..... | 41.2 | 36 |
| Length pmx.-laer. tubercle..... | 23.5 | |
| Length laer. tuberc.-lambdoid crest..... | 24.5 | 21.2 |
| Width across enlarged upper incisors..... | 6.1 | 3.8 |
| Width across laer. tubercles. (estim.)..... | 21 | 17.5 |
| Length of palate, pmx.-post. nares..... | 26.7 | 18 |
| Width post. orb. constriction..... | 6.8 | 5.5 |
| Max. width braincase (parietal eminence)..... | 13.2 | 12.3 |
| Max. width across post. tymp. processes..... | 16 | |
| P ₃₋₄ a.p..... | 4.2 | |
| M ₁₋₃ a.p..... | 6.1 | |
| Length p ₂ to condyle..... | 25 | 24 |

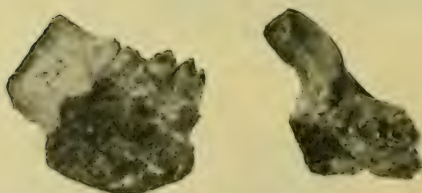
Djadochtatherium matthewi Simpson

Fig. 19 *Djadochtatherium matthewi*. Referred specimen, A. M. No. 21703. $\times \frac{3}{1}$.

The new discoveries permit a slight addition to our knowledge of the first-known of the Mongolian Mesozoic mammals.

Amer. Mus. No. 21703 is part of a right maxilla with the first two premolars preserved. Its interest lies in the fact that the structure of these teeth is clearly shown for the first time. The first one, which may be designated as P² since P¹ was probably lacking, is slightly larger than the second. Both are of a very simple and nearly identical structure and are typically allotherian: three sharp but not very slender, perfectly conical cusps, arranged in a nearly equilateral triangle with an angle external and a side internal.

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NEW LIGHT ON THE GIANT FOSSIL MAY-FLIES OF MONGOLIA¹

By T. D. A. COCKERELL

In May, 1925, in the course of the Third Asiatic Expedition of The American Museum of Natural History, Dr. R. W. Chaney collected additional materials in the original Ondai Sair locality, representing species already recorded from the same locality and horizon.²

Although there are apparently no new species, specimens of the wings of *Ephemeropsis* afford the means of revising our conception of that genus, and of placing it more accurately in the system. The best specimen, with reverse, is on a large slab close to a specimen of *Estheria middendorffi* Jones. The end of the wing is missing, but the whole length is preserved in another specimen, on a smaller piece of rock, and the wing length is seen to be 35 mm. The apex is broadly rounded, and the breadth about the middle is about 15 mm.

The two specimens referred to clearly represent the same thing, but differ in certain respects from the wing previously recorded. The first thing that struck me on examining them was the strong resemblance to *Palingenia*. This is singular, because the nymph of *Palingenia* is known and is not at all like the *Ephemeropsis* nymphs. Furthermore, upon comparing Tillyard's figure³ of the Permian *Prottereisma*, it at once becomes evident that the media of my former figure (*loc. cit.*, p. 138) is the anterior part of the cubitus and that the branched vein above it is the media. With this interpretation, the resemblance to *Prottereisma* is more striking, and I think we must consider these insects typical of a family, Ephemeropsidæ, not a subfamily of Siphonuridæ as formerly given.

The broad fork of the first cubitus in both specimens now before me emits a vein from the middle of the fork, instead of from the upper branch as shown in my former figure. This (and other smaller differences)

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 70.

²1924, Bull. Amer. Mus. Nat. Hist., LI, Art. VI.

³1923, Linnæan Soc. Journal, Zoology, XXXV, p. 145.

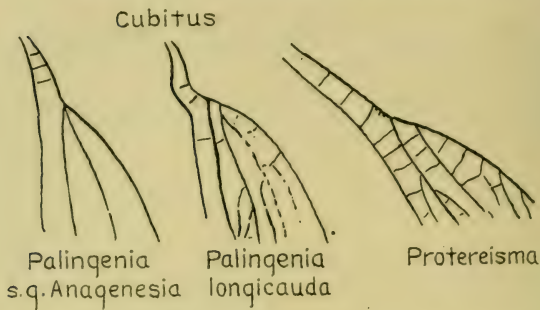


Fig. 1. Branching of first cubitus in *Protoreisma* and *Palingenia*.

may not indicate a distinct species, but it is noteworthy that it is precisely in this way that the living *Palingenia*, subgenus *Anagenesia* of Eaton, as represented by its type species *P. lata* Walker (from Silhet) and also by *P. ampla* Eaton (Sarawak), differs from the type of *Palingenia*, *P. longicauda* Olivier. However, other species of *Anagenesia*, *P. javanica* Eaton, *P. tenera* Eaton, and *P. papuana* Eaton, do not have the vein from the fork, but in this matter resemble *P. longicauda*. *Protoreisma*, as figured by Tillyard, also has the vein from the upper branch. As it is impossible definitely to connect either of the two wing types with particular nymphs, but on the whole it is perhaps most probable that they do not represent more than one species, I shall designate the formerly published figures (*loc. cit.*, p.138, figs. 3 and 4) as *Ephemeropsis trisetalis berkeyi*, and the wings now described and figured as *E. trisetalis chaneyi*.

***Ephemeropsis trisetalis chaneyi*, new variety**

(1) Subcosta very strong, greatly prolonged, reaching the costa (as shown by the second specimen) very near the wing-tip: a character of *Protoreisma*, not at all of *Palingenia*. This character is also seen in various living genera, as *Ephemera* and *Hexagenia*.

(2) First radius very strong, running below subcosta to near tip of wing, as in *Palingenia* and *Protoreisma*.

(3) Radial sector with its upper portion (Tillyard's R 2a in *Protoreisma*) comparatively weak, contiguous with R 1 at base, branching twice at very acute angles, the first branch just above the fork of cubitus, the lower division branching again about 7.5 mm. beyond. This differs from *Protoreisma* in that it certainly does not come off the lowest branch of sector as shown in Tillyard's figure. The stem of R 3 in the *Ephemeropsis* specimen is pressed against the thick stem of R 1, and

the faint stem of R 2a disappears between them; it is probably really confluent with R 4+5 at extreme base, as in *Palingenia*. The forking is much as in *Palingenia longicauda*.

(4) The lowest radial branch (R 4+5) is very stout and has a practically straight course for about 20 mm., when it forks at a rather wide angle, essentially as in both *Prottereisma* and *Palingenia longicauda* (though the angle is wider), but in the sub-genus or genus *Anagenesia* the fork is much nearer the base of the wing. In the fork thus formed are two rows of cells, the upper row deeper than the lower.

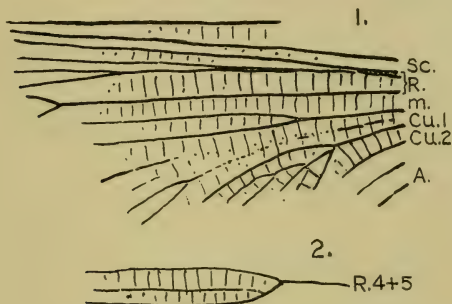


Fig. 2. *Ephemeropsis trisetalis* var. *chaneyi*.

1. Part of wing of type.
2. Detail of forking of R 4+5 in second specimen.

(5) The media is weaker and less perfectly preserved, but it forks almost at base of wing, and the upper part forks above cubital fork, about 6.5 mm. from base of wing. The lower division forks a considerable distance beyond; this is more like *Palingenia* than *Prottereisma*, but not very much like either.

(6) The first cubitus is not curved at base (as it is in *Palingenia longicauda*, but not in *Anagenesia*), and runs a slightly arched course for about 8 mm. It then offers a very wide fork, the upper branch curved (arching), the lower straight. Evenly bisecting the fork is a vein, placed as in *Palingenia lata*, but soon emitting a vein from each side, the upper one seen to fork after a short distance.

(7) The second cubitus runs evenly below the first, taking a curved course, and is connected with the first cubitus by many cross-veins, forming high, narrow cells.

(8) The anals are not sufficiently preserved to be described.

(9) The cross-veins throughout are many and closely spaced, forming high, narrow cells, with very many small cells in the distal part of the wing. This is more like *Polymitarcyx* or *Hexagenia*.

(10) The costal margin is more remote from the subcosta basally than *Prottereisam* or *Palingenia*.

(11) There is a tendency for the distal veins to approach in pairs, as in *Palingenia*; at least this is marked in the case of R 3 and R 4a, which run very close together apically instead of remaining parallel as in *Prottereisma*.

On all counts, then, the wing stands in the vicinity of *Palingenia*, with very strong resemblances to *Protereisma*. Yet the nymph is of a siphonurid type and not at all like that of *Palingenia*.¹ That the nymphs and wings belong to quite different animals, I cannot believe. An *Ephemeropsis* nymph can be seen on the same piece of rock as one of the wings. From the appearance of one of the wings it seems certain that it was brown or dusky.

¹For figure of *Palingenia* nymph, see E. Rousseau, 1921, *Les Larves et Nymphes Aquatiques des Insectes d'Europe*, p. 187.

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MURID RODENTS FROM THE ASIATIC EXPEDITIONS¹

BY GLOVER M. ALLEN

In previous papers, brief accounts have been given of the rodents obtained in China and Mongolia by the Museum's Asiatic Expeditions under the direction of Dr. Roy Chapman Andrews, the last (Amer. Mus. Novitates, No. 217, June 16, 1926) comprising the genus *Rattus*. The present report includes the remaining members of the Gerbillinae and Murinae secured during the work of the same expeditions, a collection numbering over 1300 well-prepared skins and skulls. These add considerably to present knowledge of the distribution of many species, and indicate also that much yet remains to be done toward, for example, a more precise definition of the native forms of house mice as well as a more accurate knowledge of the distribution and relations of even the introduced *Mus musculus* in China. The aberrant genera *Hapalomys* and *Chiropodomys*, climbing species with feet modified for grasping, are recorded for the first time from Chinese territory, as well as a species of *Leggada*.

Meriones auceps Thomas

Meriones auceps THOMAS, 1908, Proc. Zool. Soc. London, p. 640.

General color above sandy buff, inclining to reddish, inconspicuously lined with black; tail similar all around but slightly redder, its tip pencilled; cheeks and ear spot whitish. Below, the body and limbs are white to the roots of the hairs.

A large series was secured from various points in the Gobi Desert: Turin, Loh, Artsa Bogdo, Sair Usu, Tsagan Nor, and Iren Dabasu. It seems to be common here over a vast area, and in much the same localities as the following, from which it is said to differ in being wholly nocturnal instead of partly diurnal. Two specimens were also taken at Maitai-chao, east of Paotou, Shansi.

The shorter-tailed species, *M. psammophilus*, was not met with, and probably is confined to Chihli and Shansi, while *M. auceps* is chiefly an animal of the Gobi. Their ranges meet in northern Shansi as Thomas has indicated.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 71.

***Meriones unguiculatus* (Milne-Edwards)**

Gerbillus unguiculatus A. MILNE-EDWARDS, 1867, Ann. des Sci. Nat., Zool., (5) VII, p. 377.

Similar to *M. aeneus* but slightly darker, less clear ochraceous, the tail especially more mixed with black above. The white hairs of the lower surface are slaty at the base except on the throat.

A common and widespread species. Series were obtained in Shansi at Kweihwating, Mai-tai-chao, and in Mongolia at Loh, Sair Usu, Ussuk, Gun Burte, Artsa Bogdo, Tsagan Nor, and Iren Dabasu.

***Rhombomys opimus nigrescens* (Satunin)**

Gerbillus opimus nigrescens SATUNIN, 1902, Annuaire Mus. Zool. Acad. Sci. St. Pétersbourg, VII, p. 560.

A large sandy-buff species with a black crest on posterior half of tail; belly white, the bases of the hairs blue-gray.

A series of adults and partly grown animals from Tsagan Nor represents this race, the type of which is from Orok Nor, some fifty miles to the westward. A single skin from Iren Dabasu extends the range well to the east. Satunin points out that this Gobi race is paler than its nearest relative, *R. o. giganteus* of the Nan-shan country. The latter, as figured by Büchner, has brighter ochraceous feet and the black crest of the tail is traceable nearly to its root instead of being confined to the terminal half. Büchner refers Ala-shan specimens to typical *opimus*, but presumably they are *nigrescens*. He doubts the validity of *Rhombomys* as a genus, but it may stand for the present on the basis of (1) the second inner minute sulcus of the upper incisor, (2) the more or less well-marked division of the last upper molar into two lozenge-shaped portions by infolding of the enamel, and (3) the uninflated auditory meatus. The skull has a sharp supraorbital boundary and flattened top, while the interparietal is small and oblong or squarish in outline, unlike that of the species of *Meriones* found in the same region.

***Apodemus speciosus peninsulæ* (Thomas)**

Micromys speciosus peninsulæ THOMAS, 1907, Proc. Zool. Soc. London, p. 862.

A medium-sized mouse (head and body about 102 mm., tail 90), of a nearly uniform ochraceous buff above in winter pelage, finely lined with black hairs mid-dorsally, tail bicolor, feet white, belly and under side of limbs white with slaty bases. In summer the color is much darker above, the black tips of the hairs predominating, and the dorsal pelage tends to be somewhat hispid. Mammæ 4-4=8. The last upper molar has three lobes on its inner side.

The type locality of this race is Min-gyong, 110 miles southeast of Seoul, Korea, and specimens from North China are currently regarded as the same. Two skins in winter pelage from Nojido, Korea, are appreciably more cinnamon in color as compared with a series from 100 miles northeast of Peking and seem to have slightly larger hind feet. They may for the present, however, stand as *A. speciosus peninsulæ*, and specimens from Shensi (Tai Pei Shan and near Fengsiangfu) and Shansi (Taiyuangfu, He-shuin and Kweihwating) are similar. Two skins from 45 miles north of Urga, Mongolia, are not distinguishable from a large series taken in summer at the Eastern Tombs, Chihli.

***Apodemus speciosus latronum* Thomas**

Apodemus speciosus latronum THOMAS, 1911, Abstr. Proc. Zool. Soc. London, No. 100, p. 49, October 31.

A larger mouse than the preceding (head and body 105 mm., tail 117) with larger ears (20–21 mm.); tail equalling or exceeding body length. Longest hairs of the back measure about 14 mm. Dorsal area with greater admixture of black hairs than in *A. s. peninsulæ*.

This seems to be a large-eared, darker representative of *A. speciosus*, though specimens showing direct intergradation of the two forms have not been seen. The type locality is Tatsienlu, Szechwan, and Thomas has recorded it from Atuntsi, from the Lichiang range, 10,000 to 12,000 feet, and the Mekong-Salween divide, 9000 feet, all in Yunnan. It was found by Dr. Andrews on the Lichiang range up to timberline at 13,000 feet as well as at localities northward toward Chung-tien. Immature specimens lack almost altogether the strong ochraceous tint of the adults, but are instead a dark gray.

***Apodemus ilex* Thomas**

Apodemus ilex THOMAS, 1922, Ann. Mag. Nat. Hist., (9) X, p. 404.

A slender brownish mouse, tail slightly longer than head and body. Color above, dull fulvous brown darkened by black hairs medially, sides clearer buff. Ears thin, small, with a blackish basal tuft. Below whitish, the hairs with slaty bases. Usually a buffy spot is present at the throat, and in some specimens more or less of the entire under surface is suffused with the same color. The longest hair on the back is about 7 mm. in length.

In its general appearance and structure this is very similar to the common *A. sylvaticus* of Europe of which it may prove to be merely a subspecies. It agrees in tooth structure and in having 1–2 = 6 mammae as well. The nasals, however, equal or exceed the premaxillaries instead of being shorter, and the post-palatal border ends in a slight median spine instead of an even arch. Originally described from the Mekong-

Salween divide in Yunnan, it was secured in numbers by the Asiatic Expeditions at various localities in the same province at altitudes ranging from 7000 feet on the Salween River to 12,000 feet in the Lichiang region. Specimens in the Museum of Comparative Zoölogy from Szechwan and Hupeh are indistinguishable and extend its known range northward.

***Apodemus agrarius pallidior* Thomas**

Apodemus agrarius pallidior THOMAS, 1908, Proc. Zool. Soc. London, p. 8.

A tawny mouse, with a narrow and not very sharply defined black line from nape to tail. The color above is light ochraceous buff evenly mixed with black, but usually paler over the shoulders and on the sides than in the center of the back. Lower surfaces and feet whitish, the body hairs with dark bases. Tail indistinctly bicolor, shorter than head and body. Last upper molar with but two instead of three inner lobes.

Originally described from Shantung, this form seems to extend westward to southern Kansu and eastern Szechwan. A large series from the base of Tai Pei Shan, Tsingling Mountains, southern Shensi, is fairly uniform, and is not appreciably different from a series taken at Wanh sien in eastern Szechwan. The narrowness but usual presence of the dorsal line as well as the indefinite grayish tint of the shoulder area are distinguishing features. In a very few of the large series from Wanh sien, the black stripe is obsolescent, showing in this respect a transition toward the race *ningpoensis*.

***Apodemus agrarius mantchuricus* (Thomas)**

Mus agrarius mantchuricus THOMAS, 1898, Proc. Zool. Soc. London, p. 774.

A mouse with a broad clear line of black from the nape to base of tail; remainder of upper surfaces a uniform ochraceous buff mixed with black, paler at the sides; lower surfaces and feet white, tail bicolor.

Four adults of the striped-backed mouse from the Eastern Tombs, Chihli Province, are richer in tone than the preceding race, and three have the dorsal stripe much broader and clearer black, though in the fourth it is narrower. These are probably referable to *mantchuricus* though the belly is without the wash of tawny said to be characteristic of this race. No doubt they are somewhat transitional here between the two races.

***Apodemus agrarius ningpoensis* (Swinhoe)**

Mus ningpoensis SWINHÖE, 1870, Proc. Zool. Soc. London, p. 637.

In the South China race, the black dorsal stripe tends to disappear and is developed chiefly on the middle of the back from shoulders to rump; the color of the body is slightly brighter, the tail slightly longer and more sharply bicolor than in *A. a. pallidior*.

A series from Yochow, Hunan Province, represents this subspecies. Of thirty-two specimens three or four have the black stripe about as well developed as in the form *pallidior*, but the majority have it very poorly marked or nearly obsolete on the lower back, while eight or ten either lack it altogether or have merely the faintest indication, discernible only on close scrutiny. This series evidently bridges the gap completely between *A. a. pallidior*, *A. a. ningpoensis*, and the form *chevrieri* which has hitherto been regarded as a separate species, but which, as Thomas has already suggested, is undoubtedly merely an upland race in which the dorsal stripe is wholly lacking.

***Apodemus agrarius chevrieri* (A. Milne-Edwards)**

Mus chevrieri A. MILNE-EDWARDS, 1868-74, 'Recherches Hist. Nat. Mammifères,' p. 288, Pl. XL, fig. 2.

Similar to *A. a. pallidior* but slightly richer, less grayish, in coloration and wholly lacking the black median dorsal line. Back darkened by an even admixture of black-tipped hairs; the sides more nearly clear ochraceous buff, a tint that is obviously brighter on the posterior part of the body.

There seems to be no doubt that *chevrieri* is after all but an upland race of *A. agrarius* in which the black dorsal stripe is lacking. A series from Yochow (Hunan), as noted, seems to bridge the gap, and elsewhere, as at Hsienshanhsien, Hupeh Province (specimen in Museum of Comparative Zoölogy) and in southern Kansu (the *Apodemus fergussoni* of Thomas), intermediate individuals seem to occur.

A very large series of this mouse was secured from various localities in western Yunnan at altitudes from 6000 feet (Taku Ferry, Yangtse River) to 12,000 feet (Lichiang). There is very little variation in color, though two skins from 7000 feet at Mucheng, Salween drainage, seem slightly brighter in tint than the average, and constitute the most southwesterly record for the species.

Six females taken October 5, 1916, at 9000 feet, near Lichiang, contained embryos, from four to seven in number.

***Leggada cookii* (Ryley)**

Mus cookii RYLEY, 1914, Journ. Bombay Nat. Hist. Soc., XXII, p. 664.

Size and general appearance of a house mouse but tinged with ochraceous, and lower parts whitish with slaty bases of the hairs showing through; tail slightly longer than head and body.

The characters separating the house mice (*Mus*) from the jungle mice (*Leggada*) have recently been reviewed by Thomas (1919, Journ. Bombay Nat. Hist. Soc., XXVI, p. 417), and the latter genus with its

longer muzzle is shown to be a distinct and natural group (distance from gnathion to front bottom corner of zygomatic plate exceeding breadth across molars).

Four specimens from the Namting River, near the Burma border, western Yunnan, 1700 feet, are referred to this species, the type locality of which is Gokteik, northern Shan States, Burma. In addition to the color and proportions, it is further distinguished from the other jungle mice by the skull with braincase exceeding 10 mm. in width, and with the incisive foramina extending back to the molars or very slightly between them. This is apparently the first record of the genus in Chinese territory, although Thomas has recorded *L. pahari* from near the southern border of Yunnan in Tonkin. In addition to the four from the lower levels of the Namting River, a series was also secured from higher altitudes in western Yunnan, which differs uniformly in the much grayer coloring, as described below.

***Leggada cookii meator*, new subspecies**

TYPE.—Adult male, skin and skull, No. 43609, American Museum of Natural History, from Taipingpu, Shweli River, western Yunnan, 8000 feet. April 9, 1917. R. C. Andrews and E. Heller.

DESCRIPTION.—Dorsal surfaces of a general drab or dark mouse gray, resulting from a mixture of stronger slate-colored hairs with finer, dark-based hairs narrowly tipped with pale ochraceous. Ears thinly haired, dusky; feet white. Lower surfaces gray, not sharply marked off from the color of the sides, the hairs pale gray at base, their terminal half whitish. Tail about equalling or slightly exceeding head and body, sparsely haired, its rings evident; above dusky, below whitish.

SKULL.—The skull agrees in its general characters with those given for *cookii*. The brain case is broad, oval, with a strap-shaped interparietal, produced forward to a blunt point medially. The orbital edge is square but not conspicuously thickened, and the outer corners of the parietals project forward as a tapering process, overlapping the frontals slightly. Nasals long, extending back about a millimeter behind the level of the front edge of the orbits. The incisive foramina usually fall just short of the molar level, though rarely they may extend a minute distance between the anterior molars, and the convex front edge of the zygomatic plate is slightly behind their middle point. Teeth as in *Mus*, with the notch on the upper incisors usually well developed.

MEASUREMENTS.—The type was measured by the collectors as follows: head and body, 87 mm.; tail, 80; hind foot, 20; ear, 14. The skull measures: greatest length, 23.8 mm.; basal length, 20.5; palatal length, 11.8; diastema, 5.7; zygomatic breadth, 11.6; mastoid breadth, 10; breadth of brain case, 11.1; gnathion to front bottom corner of zygomatic plate, 5.8; greatest breadth across molars, 5.0; upper molar row, 4; lower molar row, 4.

A series of eighteen of these jungle mice from localities in the mountains of western Yunnan agree in their dull gray or drab coloration and differ markedly from the much brighter, more rufous representatives of

the species from the lower country along the Burma border (1700 feet). Specimens were taken at Homushu Pass (8000 feet); Sha-sung-shao, Mekong drainage (7500 feet); Taipingpu, Shweli River (8000 feet); Tashuitang, Salween drainage (6000 feet); and Yangpi River, Tengyueh road (5000 feet). They bear a certain superficial resemblance to *Apodemus ilex*, but may be distinguished by the shorter ear and hind foot, while a glance at the skull with its *Mus*-like teeth, incisive foramina penetrating to the molar level, and the antero-lateral projection of the parietal will at once separate the two. Their ranges meet at about the 7000-foot level, below which the *Leggada* seems to take the place of the other. The extension of this Oriental group into extreme western Yunnan is an interesting discovery.

***Micromys minutus pygmæus* (A. Milne-Edwards)**

Mus pygmæus A. MILNE-EDWARDS, 1868-74, 'Recherches Hist. Nat. des Mammifères,' p. 291, Pl. XLIII, fig. 1.

A small mouse of a dull yellowish brown above, somewhat more ruddy over the rump, the hairs of the lower surfaces dark-based, tipped with gray and more or less washed with buffy. Tail slightly longer than head and body, its extreme tip nearly or quite bare above.

A small series of the harvest mouse was secured by the Asiatic Expeditions at Wanhshien, 2500 feet, in eastern Szechwan, and at several localities in western Yunnan on the Mekong and Salween drainages, 4000 to 8000 feet. The type locality is Moupin, Szechwan. All the specimens are very uniform in coloration.

***Mus musculus* Linnæus**

Mus musculus LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 62.

In the introduced house mouse the belly hairs are either gray throughout or gray washed with ochraceous. Specimens of the latter type from India are referred by Wroughton to *Mus dubius*. A series from Yenping, Fukien Province, China, taken by Rev. H. R. Caldwell, shows both extremes, but is regarded as *musculus*, here introduced. Cabrera has recently proposed the name *Mus musculus sinicus* for the house mouse of eastern China (type locality, Ningpo, Chekiang Province), on the ground of small size, dark color, and ochraceous wash below as compared with Indian specimens representing *Mus musculus urbanus*. The differences, however, seem likely to fall within the range of normal variation for the typical race. A single skin from Lichiang, 9000 feet, Yunnan Province, seems also to be the introduced variety.

Mus bactrianus GROUP

Small sandy-backed, white-bellied mice with the general appearance of the European house mouse seem to occur in a wild state over much of temperate and subtropical Asia. The oldest name available for these is apparently *Mus bactrianus* Blyth, 1846, the type locality of which is Kandahar, central India. Wroughton (1920, Journ. Bombay Nat. Hist. Soc., XXVI, p. 958), in summarizing the work of the Mammal Survey of India, includes but this single form of white-bellied house mouse from that country, and Thomas has suggested further that it may be found to merge with typical *Mus musculus* through such a form as *gentilis*. The American Museum of Natural History has a series from Kashmir and Ladak that corresponds entirely with the description of *bactrianus*. These are pale sandy above (a buffy gray), white below, with the bases of the hairs on the lower surfaces blue-gray; the feet are white, the tail is obviously paler below, and it is shorter than the head and body, averaging 47% of total length in a series of 16 (extremes 46 and 50%).

The work of the Asiatic Expeditions under Dr. R. C. Andrews has resulted in bringing together a large series of mice of this type from China and Mongolia, while others are available in the Museum of Comparative Zoölogy through the F. R. Wulsin Expedition. A study of the entire lot makes it clear that in western Yunnan and southeastern China the representatives of *bactrianus* are relatively longer-tailed, with tail more than 50% of the total length, while the hairs of the lower surfaces have more extensive gray bases, giving a darker effect. The specimens available from Szechwan are again different, with proportionally shorter tails and a decided buffy collar often extended as a buffy wash over the white belly. Passing northward to the dry country of Shensi and northern China there is a progressive shortening of the tail and paling of the color, until the edge of the Gobi Desert is reached with a very short-tailed mouse having a pure white belly to the roots of the hairs. The first of these races corresponds exactly with Anderson's description of *Mus kakhynensis* from Ponsee near the border of western Yunnan; to the second no name seems to have been given; while for the third, *Mus gansuensis* Satunin is available, with *Mus wagneri mongolium* Thomas as a synonym. The relationship of *Mus wagneri* Eversmann (1848) from Turkestan, to the other members of the group is apparently still in need of further elucidation.

Mus bactrianus kakhynensis Anderson

Mus kakhynensis ANDERSON, 1878, 'Anat. and Zoöl. Researches Western Yunnan,' p. 307.

Above sandy, the central area of back darkened slightly with black hairs; below, white, the hairs with obvious gray bases showing through; feet white; tail longer than head and body, distinctly white below.

Five specimens from extreme southwestern Yunnan near the Burma border (5000 feet) agree in every respect with Anderson's description of *Mus kakhynensis*, of which they are nearly topotypes. The tail is obviously longer than head and body amounting to 53% (average of five specimens) of total length, a character which, with the more prominently gray bases of the hairs below, will distinguish the form from typical *bactrianus*. In addition to these, the collections include a large series from the island of Hainan taken by Mr. Clifford Pope and two from the adjacent mainland of Fukien, all quite similar except that the tail length averages a little less, about 51.6% of total length. Probably, therefore, this race extends across the entire southern part of China at lower levels. It is also an addition to the recorded fauna of Hainan.

Mus bactrianus tantillus, new subspecies

TYPE.—Adult female, skin and skull, No. 56413, American Museum of Natural History, from Wanhsien, Szechwan Province, China. November 14, 1921. Third Asiatic Expedition.

DESCRIPTION.—Tail nearly or quite equalling head and body (averaging 49% of total length); hairs of the belly dark-based, tipped with white; throat buffy.

Above, the color is sandy, resulting from a mixture of buffy-tipped with black hairs, the latter more numerous over the rump, giving a slightly darker effect mid-dorsally. Sides clearer buffy. Lower surfaces with the hairs gray-based, tipped with white. Throat with a buffy collar. A suffusion of buffy may extend to most of the under surfaces. Ears dusky. Feet dusky, the toes whitish; tail indistinctly bicolor. Mammaræ 3-2=10.

SKULL.—The skull shows no special peculiarities. The backward extension of the incisive foramina nearly to the level of the antero-internal root of m^1 , the narrow mesopterygoid fossa with a slight median projection of the palate at its anterior end, and the forward prolongation of the parietals to a slender point on each side are characters found in other races.

MEASUREMENTS.—The type was measured by the collector as follows: head and body, 78 mm.; tail, 70; hind foot, 15; ear, 12.

The skull of the type measures: greatest length, 20 mm.; basal length, 17; palatal length, 10.3; diastema, 5; zygomatic width, 10.9; mastoid width, 9; width of braincase, 9.5; upper cheek teeth, 3.5; lower cheek teeth, 3.5.

A series of these mice from Wanhsien, eastern Szechwan, agrees in having the tail about half the total length (average of eight, 49%), the

belly with gray bases to the hairs, the throat with a buffy collar, and the hind feet dusky. To the north, intergradation takes place with the short-tailed desert race, *gansuensis*. Thus, while specimens from Tai Pei Shan are typical, a series from 45 miles south of Fengsiangfu, Shensi, has the tail still shorter, averaging 46% of total length, the buffy collar is usually absent (present in two of six), the feet are white and the dark bases of the belly-hairs less extensive. Six in winter pelage from near Peking are fairly typical, though in one the buffy collar is reduced to a median spot. A single skin from Eastern Tombs, Chihli, has the belly and throat white to the roots of the hairs, as in the subspecies following. Specimens from eastern China have not been seen.

This is a species apparently of open and cultivated fields, but comes into the human habitations as well, with much the familiarity of the common house mouse. It seems altogether likely that some form of this Chinese mouse represents the original stock from which the tame black-and-white waltzing mouse of Japan is derived. The evidence on this point has recently been summarized by Gates (1926, Publ. Carnegie Inst. Wash., No. 337), while Fortuyn (1912) has proposed the name *Mus wagneri rotans* for the tame animal, a name which on account of the shortness of the tail-to-total-length ratio may be included in the synonymy of the race *gansuensis*.

Mus bactrianus gansuensis Satunin

Mus (Leggadia) gansuensis SATUNIN, 1902, Annuaire Mus. Zool. St. Pétersbourg, VII, p. 564. Kansu.

Mus wagneri mongolium THOMAS, 1908, Proc. Zool. Soc. London, p. 106.

This is a pallid, short-tailed race characteristic of the desert country from eastern Mongolia southwestward across northern Shansi to Kansu. Its relationship to *bactrianus* seems evident but specimens from Central Asia are unavailable. The dorsal coloring is a pale sandy buff, not darkened medially, the lower surfaces and feet are pure white to the roots of the hairs, and the tail is indistinctly bicolor. In three Mongolian specimens, secured by the Asiatic Expeditions at Tsagan Nor, Gun Borte, and Ula Usa respectively, the tail averages 40% of the total length, but the feet and ears are as long as in the previous race. The measurements given for the type of *gansuensis* (from Tschortentan, Kansu) indicate a tail 42% of the total length. The Museum of Comparative Zoölogy has a series of skins collected by F. R. Wulsin near Yirgo, Shansi, that is quite the same, and it seems that those described from the edge of the Mongolian plateau north of Kalgan, Chihli, as *Mus wagneri mongolium* agree in

the characters given. Such specimens as those mentioned above from Eastern Tombs and southern Shensi are clearly intermediate between this and the previous race.

***Chiropodomys fulvus*, new species**

TYPE.—Adult female, skin and skull, No. 43989, American Museum of Natural History, from Yinpankai, Mekong River, western Yunnan, China, 9000 feet altitude, December 24, 1916. R. C. Andrews and E. Heller.

DESCRIPTION.—Pelage full and almost silky. Entire dorsal surfaces except the ears and tail, but including the backs of the fore and hind feet, fulvous, very slightly darkened over the lower part of the back by scattered fine black hairs. Cheeks and flanks clear bright fulvous. Forehead and top of head slightly darkened and grayer than the back. Ears sparsely covered with short hairs, fulvous on the inner surface; on the pro-ectote, however, contrastingly blackish. Under surfaces from chin to anus, the entire forearm, and the hind leg to near the ankle, white, not very sharply marked off at the sides. The chin and throat as well as the under side of the forearms are white to the roots of the hairs, but elsewhere the hairs are slaty for their basal half and a small median fulvous spot is present on the chest. A few hairs at the tips of the toes above are silvery white. Tail sparsely haired, with a slight terminal pencil; its color uniformly dusky except on its basal half below where it is buffy. Vibrissæ long, black, reaching to the tips of the ears. Mammæ 2-2=8

SKULL.—The rostrum, as in other members of this genus, is relatively short (slightly more than one-fourth the length of the skull), and there is practically no antorbital notch. Anterior edge of zygomatic plate is slightly concave. The braincase is broad and somewhat flattened, the jugals are very slender, and the nasals, which extend back to the level of the zygomatic arch, are exceeded by the ascending branch of the premaxillaries. Very striking is the median groove or depression beginning at about the anterior third of the nasals and extending back to the border of the parietals. This depression is widest posteriorly and is bounded in the inter-orbital region by a rounded ridge on either side of the frontals. In ventral view, the incisive foramina just reach the level of the anterior molars, while posteriorly the interpterygoid fossa just about reaches the level of the hindmost molars. The first upper molar, as usual, shows three transverse rows of three tubercles each, with a postero-external accessory cusp. The second molar is similar except that the anterior row is so reduced that its median tubercle has disappeared. In its somewhat worn condition the last upper molar appears to consist of two transverse plates. In the lower jaw the coronoid process is as usual small. The first lower molar consists of an anterior trefoil followed by two transverse rows of three cusps each. The second molar consists of three transverse rows, each of three cusps, but the outer cusps are reduced in size, and the posteriormost row is so narrowed that it appears hardly more than a crescent-shaped ridge with a minute outer cusp.

MEASUREMENTS.—The collector's measurements are: head and body, 75 mm.; tail, 133; hind foot, 18.5; ear, 17. The skull measures: greatest length, 22.3 mm.; basal length, 18.5; palatal length, 10.6; length of nasals, 6.7; zygomatic width, 11.7; mastoid width, 9.5; upper molar row, 3.3; lower molar row, 3.8.

The single specimen of this small, bright-colored mouse with long tail agrees with *Chiropodomys* in having flat nails on the pollex and hallux only, and in having the latter opposable to the rest of the hind foot. The number of mammae in the genus is said to be $0-2=4$, but in the present specimen is very clearly $2-2=8$. Its more slender proportions and the dark bases of the belly fur are obvious points of difference in comparison with other known members of the genus, of which this appears to be the first Chinese record.

***Hapalomys marmosa*, new species**

TYPE.—Adult female, skin only, No. 59046, American Museum of Natural History, from near Nodda, island of Hainan, China. December 27, 1922. Clifford Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—General form rat-like, but with the hallux opposable, its terminal joint broad and provided with a flat nail. Other digits with compressed short claws, hardly exceeding the terminal pads. Tail slightly longer than head and body, scaly, nearly naked, its sparse short hairs hardly longer than the width of a scale-row except near the tip where they form a slight pencil and are about the length of four scale rows. Vibrissae prominent, black, slightly longer than head. The otherwise nearly naked ears are remarkable for the long stiff hairs projecting out from the inner surface of the conch and there is a tuft of similar hairs at their anterior base.

The pelage is soft and fine in texture, about 12 mm. long mid-dorsally, of a nearly uniform dull reddish gray (near cinnamon, Ridgway, 1912) only slightly admixed with scattered blackish hairs. The sides are paler, the feet and limbs buffy gray. The entire under surface including fore legs, and the hind legs to below the knee, is pure white to the roots of the hairs. Ankles below, and tail with its short hairs, dusky.

SKULL.—The specimen is unfortunately unaccompanied by a skull so that a description of the cranial characters must await the collection of additional specimens.

MEASUREMENTS.—The type was measured by the collector as follows: head and body, 130 mm.; tail, 138; hind foot, 21; ear, 12.

The discovery of this genus in Hainan constitutes an addition not only to the known fauna of that island but to the fauna of China as well. It is a shorter-tailed animal than the Indian *H. longicaudatus*, with conspicuously hairy ears (a trait noticeable also in the arboreal octodont *Diplomys* of America). Like the other members of the genus it is doubtless a tree-liver, its grasping hind foot recalling that of an opossum.

Article II.—THE FISHES OF HAINAN¹By JOHN T. NICHOLS AND CLIFFORD H. POPE²

PLATE XXVI, TEXT FIGURES 1 TO 51

INTRODUCTION

Prior to the work of The American Museum of Natural History's Asiatic Expeditions, the fresh-water fishes of Hainan Island off the coast of south China were very little known. Boulenger has reported on a collection of five species obtained in the interior of the island by Mr. John Whitehead, who died in Hainan in 1899 after a short stay there. (Proc. Zoöl. Soc. London, 1899, pt. 2, pp. 959-961, Pl. LXVIII and LXIX). Three of the five he lists as new, referring the other two respectively to a Burmese and Japanese species. Our Hainan collection contains the last-mentioned form, a *Zacco* which we have no hesitation in separating from Japanese species, though they are close; and we have some doubt in following Boulenger in the identification of his Hainan *Garra* with one from Burma.

The extensive collection on which the present paper is based was made in the vicinity of Nodda in the late winter of 1922-1923 and spring of 1923 by C. H. Pope. Nodda is situated in a foothill region where both swift-water (mountain) and sluggish-water (plains) fishes were to be met with, and, although from but a single locality, the forty-nine species probably give a very fair idea of the fishes of the island. Bearing this in mind, as also the size and isolation of Hainan and its large percentage of endemic fresh-water fishes, we have drawn up this paper in the form of an account of the fishes of Hainan, rather than merely a report on our collection as would have been appropriate for material of similar extent from some point on the mainland of China, for instance on the Yang-tze. Of the small number of forms in Hainan from the mainland of China, most are common or widely distributed—for instance, the carp, goldfish, Japanese eel "monopterus," snakeheads (*Ophicephalus maculatus* and *gachua*), *Channa* paradise fish, and *Barbus semifasciatus*, the two latter species commonly kept in aquaria. Perhaps some of the supposedly endemic species will prove to be identical with species in Indo-China and Malay, with the fishes of which region the authors are much less familiar than with those of China proper. The *Parasilurus* is identified with *P. cochinchinensis*, an *Acanthorhodeus* with *A. tonkinensis* (close

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 72.

²The colored plate is by Mr. Wong of Pekin; the line drawings are by Miss Olive Otis.

to *A. quichinoti*), both southern representatives of species abundant in central China. We find no endemic fresh-water genera in Hainan.

Since the completion of this paper Oshima (1926) has reported on a collection of fresh and brackish water fishes from Hainan, describing several new species and listing a number not previously recorded from the island. As it is not our purpose to include brackish water forms with marine affinities, or marine forms the occurrence of which in fresh water is fortuitous, the following (mostly from Haiho) have not been included.

Elops saurus, *Harengula fimbriata*, *Anodontosoma chacunda*, *Dorosoma nasus*, *Clupanodon haihoensis* Oshima (1926), *Mugil carinatus*, *M. nepalensis*, *Caranx forsteri* (Haiho, and also Kachek River), *Sparus datnia*, *Gerres punctatus*, *G. poeti*, *G. limbatus*, *Bostrichthys sinensis*, *Apo-cryptes maculatus* Oshima (1926), *Rhinogobius punctatus* Oshima (1926, Haiho), *Boleophthalmus chinensis*.

Of two new genera which Oshima proposes, the one, *Spinibarbichthys*, our view would not admit to generic rank, the other, *Carassioides*, we suspect of being the hybrid between carp and goldfish for which generic and specific names were already available.

It is a (necessary) pleasure to use Oshima's names for 3 new forms which we also had to hand from the vicinity of Nodoa, one of his we think we have identified with *Acanthorhodeus tonkinensis* from the mainland, and 1 or 2 of ours which he seemingly had but failed to differentiate from known species, we are not yet prepared to relinquish.

The ichthyological work of the Third Asiatic Expedition in Hainan extended over a period of eight months, beginning December 1922 and ending July 1923. Most of the fish were taken in the early spring, for at that time the streams were low and the fish forced to gather in isolated or barely connected pools.

Nodoa was the center of activity, as all of our specimens were secured within fifteen miles of this town, the vast majority having been taken from water in its immediate vicinity. Nodoa's location is an especially good one for it lies in the hilly, rolling country of the area intermediate between Hainan's northern plain and central highland. This market town is slightly nearer the island's center than its north-western coast and about forty miles from the famous Five Finger Mountains. A distance of ten miles directly north brings one out on the low plain, while the wildest section of the highland is only twenty miles to the southwest.

The fishes recorded herein as having been caught in the "immediate vicinity" of Nodoa were taken from one of the following sources:

ricefield irrigation ditches and reservoirs; or sluggish streams rising in the lower foothills; or a small river which, though rising in the foothills, flows for some miles down a series of cascades.

All specimens were secured first-hand or directly from fishermen. For more than three months natives were paid to fish the waters about Nodoa using their own nets. Such methods, while more or less primitive, in the long run yield excellent results. Many rare forms may be secured in this way. More drastic methods were employed when the headwaters of the Golden River were investigated for river and mountain forms. This, the island's largest river, flows within five miles of Nam Fong, which is itself only ten miles south of Nodoa.

It should be noted that our collecting was entirely confined to fresh waters and that most of our fishing was done in streams, pools, and ditches. Hainan is only a small island and its fresh waters are not extensive.

The authors fully realize that this work could never have been carried on had it not been for the hospitality, generosity, and continued help rendered by the members of the Nodoa Station of the American Presbyterian Mission, Hainan. This opportunity is taken to express deepest gratitude for assistance so graciously rendered.

A small stream rises just northeast of Nodoa in low, rolling country. For about two miles it is little more than a series of shallow, barely connected, grass-grown pools crowded by ricefields. In its third mile it picks up and begins to flow through the dense vegetation that crowds its bed of solid rock. Now and then it forms an open pool comparatively free of vegetation. We selected one of these in the third mile and one of the lagoon-like, grassy pools of the second mile and made an investigation of the fish life of each, the results of which are set down below.

The open, basin-like pool in the third mile of the stream's course was partly shaded, circular, 150 feet in diameter, 4 to 8 deep, and has a gravel bottom. The borders and bottom are practically free of vegetation. There are no overhanging banks. Our fairly clean sweep of the fishes of this pool was made late in February before they had been scattered by the spring rains. Twelve hundred and fifty-nine specimens were counted as follows:

| | |
|---|--------------|
| <i>Ischikauia hainanensis</i> | 665 examples |
| <i>Osteochilus salsburyi</i> ,..... | 222 " |
| <i>Acanthorhodeus tonkinensis</i> | 160 " |
| <i>Pseudoperilampus hainanensis</i> | 76 " |
| <i>Carassius auratus</i> | 47 " |

| | |
|--|-------------|
| <i>Barbus semifasciolatus</i> | 37 examples |
| <i>Hemibarbus</i> and <i>Pseudogobio</i> | 25 " |
| <i>Hemiculter hainanensis</i> | 19 " |
| <i>Barbus nigrodorsalis</i> | 2 " |
| <i>Cobitis tænia dolichorhynchus</i> | 1 " |
| One species uncertain..... | 5 " |

The grass-grown, partly-shaded, lagoon-like pool in the second mile of the stream's course was murky and wedged in between ricefields. It had a sand and mud bottom, was three to five feet deep, a hundred yards long by ten wide, and one of its banks was densely overgrown and overhanging. Probably we missed many catfish and examples of *C. t. dolichorhynchus* (later on with a net we got many examples of the latter in this same pool). Twelve hundred and seventy specimens were counted as follows:

| | |
|---|--------------|
| <i>Barbus semifasciolatus</i> | 520 examples |
| <i>Acanthorhodeus tonkinensis</i> | 394 " |
| <i>Ischikauia hainanensis</i> | 160 " |
| <i>Pseudoperilampus hainanensis</i> | 86 " |
| <i>Osteochilus salisburyi</i> | 34 " |
| <i>Carassius auratus</i> | 30 " |
| Four species uncertain..... | 46 " |

The following species were constantly taken in the immediate environs of Nodoa.

Fluta alba xanthognatha
Clarias fuscus
Parasilurus cochinchinensis
Pseudobagrus virgatus
Cobitis tænia dolichorhynchus
Misgurnus mizolepis hainan
Nemacheilus pulcher
Cyprinus carpio
Carassius auratus
Barbus nigrodorsalis
Barbus semifasciolatus
Osteochilus salisburyi
Hemibarbus labeo
Pseudogobio labeoides
Zacco asperus
Opsariichthys hainanensis
Ischikauia hainanensis
Magalobrama melrosei
Hemiculter hainanensis
Rasbora hainanensis
Aphyocypris normalis
Acanthorhodeus tonkinensis

Pseudoperilampus hainanensis
Aplocheilus curvinotus
Ophicephalus maculatus
Channa ocellata
Macropodus viridiauratus
Philypnus chalmersi
Gobius hadropterus

Four species, as follows, were not taken in the mountains and were only very rarely found near Nodoo:

Anguilla japonica
Garra schismatorhyncha
Sarcocheilichthys hainanensis
Hemiculter serracanthus

The following three fishes were apparently confined to the higher mountain streams some miles south of Nodoo.

Glyptosternon hainanensis
Gastromyzon leveretti
Cyclocheilichthys iridescens

Several species were taken in the Golden River at its point of emergence from the mountains five miles southeast of Namfong. As the lower reaches of the river were not fished, we do not know how generally they are distributed down stream. Such are:

Barbus denticulatus
Barbus barbodon
Varicorhinus discognathoides
Onychostoma leptura
Labeo collaris
Erythroculter pseudobrevicauda

ELOPIDÆ. The Tarpons

Herring-like fishes with large mouth, projecting lower jaw, lateral line, and no ventral keel.

MEGALOPS Lacépède

LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 289. Type *Megalops filamentosus* Lacépède = *Clupea cyprinoides* Broussonet.

Large compressed fishes with large silvery scales, running into fresh water from the sea. The dorsal fin with its last ray produced.

Megalops cyprinoides (Broussonet)

Clupea cyprinoides BROUSSONET, 1782, Ichthyologia, I, Pl. ix.

Depth, in length to base of caudal, about 3.5; head, about 3.5. Eye in head 3.2 to 3.5; snout, and interorbital, about 6.5. Dorsal rays 19 to 21; anal 24 to 27. Scales in lateral line 37 to 42.

Recorded by Oshima (1926) from Haiho, Hainan.

ANGUILLIDÆ. The True Eels**ANGUILLA Shaw**

SHAW, 1803, 'General Zoology or Systematic Natural History,' IV, p. 15. Type: *Anguilla vulgaris*.

This genus is distinguished from its relatives by the presence of small, embedded, linear scales placed in groups, those of one group at right angles to those of adjoining groups. Its species are indifferently coastal or fresh-water and retire to the deeps of ocean basins under the warm water of the open sea to spawn. The young pass through a flat, translucent, pelagic, larval stage. The common fresh-water eel of Japan (and of China) is very like that of Europe and that of the Atlantic slope in America.

***Anguilla japonica* Temminck and Schlegel**

Anguilla japonica TEMMINCK AND SCHLEGEL, 1847, p. 258, Pl. cxiii, fig. 2.

But a single specimen of *Anguilla*, which is common in the Yang-tze, was obtained at Hainan. It was this species.

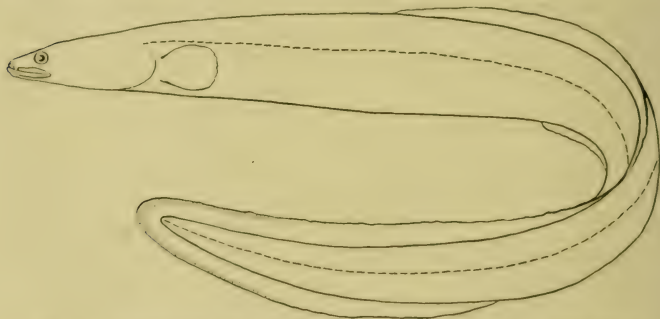


Fig. 1. *Anguilla japonica* Temminck and Schlegel. 440 mm. without caudal.

Length to base of caudal 440 mm. Head in length 7.9, tail 1.7. Depth in head 2; snout 5.3; maxillary 3.4; pectoral 3. Eye in snout 3. Anal origin behind dorsal origin a distance contained 1.2 in head.

Body little compressed, snout depressed, tail compressed. Dorsal beginning far behind head. Lower jaw projecting, lips fleshy; maxillary extending to beyond eye

Olivaceous, belly abruptly pale, caudal and posterior dorsal and anal dusky edged.

For comparison, a specimen 345 mm. in length to base of caudal, Tung-ting Lake, Hunan, December 9, 1921, is as follows. Head in length 8.4; tail 1.6. Depth in

head 2.5; snout 5; maxillary 3.1; pectoral 3. Eye in snout 3. Cylindrical, snout depressed; tail somewhat compressed. Anal origin behind that of dorsal a distance contained 2.5 in head, considerable divergence here likely individual or age variation.

We unhesitatingly refer the Hainan specimen to *Anguilla japonica*, to which Oshima (1919, *Annals. Carn. Mus.*) refers the common Formosan form, and doubt the distinctness of *Anguilla sinensis* McClelland (1844, *Calc. Jour.*, IV, p. 406, China) to which the Tungting specimen should belong.

My Hainan fishermen caught only one specimen of *Anguilla*, and insisted that it was not only the rarest but most delicious "fish" found about Nodda.

***Anguilla mauritiana* Bennett**

Anguilla mauritiana BENNETT, 1831, *Proc. Comm. Zool. Soc.*, p. 128. Mauritius.

East Indian oceans and archipelagoes in general, recorded by Oshima (1926) from the Kachek River, Hainan. Irregularly spotted with blackish; the dorsal origin more anterior than in *A. japonica*, nearer to the pectoral than to the anal origin.

SYMBRANCHIDÆ. Symbranch Eels

Slender, scaleless, more or less finless fresh-water eels of southern Asia and the Indies and tropical America. The gill openings are joined on the under surface of the head to form a single cleft. A few, sometimes very wide-ranging species.

***Fluta* Bloch and Schneider**

BLOCH AND SCHNEIDER, 1801, 'Systema Ichthyologiæ,' p. 525. Type: *Monopterus javanensis* Lacépède = *Fluta alba* (Zuiew).

***Fluta alba* (Zuiew)**

Muraena alba ZUIEW, 1793, *Nova Acta, Acad. Sc. Petropol.*, VII, p. 299.

The *Fluta* from Hainan may be differentiated from that found in the Yang-tze basin (*Fluta alba cinerea*) by shorter tail, smaller eye, and higher, more gibbous nape. None of our fourteen Hainan specimens (172 to 455 mm. in total length) show the rather bold, blackish spotting frequently found in *cinerea*. They have head in length to vent 8.1 to 10.3 (average 9.5); tail from vent 2.5 to 3.3 (average 2.9); eye in snout 1.7 to 3 (average 2.3), with tendency to decrease of size of eye, slight decrease of length of tail and increase of length of head with increase of size. The eye is about one-half the snout at 200 mm. total length, about one-third at 400 mm.

***Fluta alba xanognatha* (Richardson)**

Monopterus xanthognathus RICHARDSON, 1844, 'Voyage of the Sulphur,' p. 118, Pl. LII, Canton.

Description of a specimen taken March 30, 1923 at Nodoa:

Total length 174 mm. Head (to posterior angle gill-opening) 12.4 in length; tail from vent 4.1. Depth in head 2.2; gape (snout to angle mouth) 2.4; snout 4.4; maxillary 2.3; distance between posterior corners of gill slit 3.4. Eye in snout 2.1;



Fig. 2. *Fluta alba xanognatha* (Zuiew). 395 mm. total.

width lower lip 2; interorbital 1.7. Snout bluntly pointed; lower jaw slightly included; eye small, beneath skin, over middle of mouth; gill opening ventral, V-shaped, angle of the V somewhat less than a right angle. Body cylindrical, slightly deepest at shoulder, without fins or ridges; tail compressed, tapering, a low keel along three quarters of its upper and two thirds of its lower edge; profile of head low, slightly concave over the eye and convex at nape. Color uniform ash-gray. A color sketch from life is dusky olive above, finely freckled with blackish; bright orange band below; dusky mark downward and backward of the eye.

SILURIDÆ. Catfishes

Scaleless fishes, ordinarily with a transverse, more or less terminal mouth surrounded by several pairs of conspicuous barbels. Dorsal and pectoral fins each with a spine, frequently serrate, more or less developed or absent. When the dorsal is short there is usually an adipose fin situated more posteriorly on the back. Catfishes are scarce in Europe and northern Asia, plentiful in southern Asia and eastern temperate America, abundant and varied in Africa, and perhaps reach their greatest development in tropical America, where there is a large, specialized, armored, offshoot family, the Loricariidæ. Catfishes are mostly inhabitants of fresh water; there are a few tropical or subtropical, marine coastwise genera.

CLARIAS Scopoli

SCOPOLI, 1777, following Gronow, 1763, 'Zoophylacæum,' p. 100.

Type: *Clarias orontis* Günther.

Elongate catfishes; the dorsal, without spines, extending the length of the back, longer than the anal, which is also long. Top and sides of the head bony. Four pairs of barbels. Caudal truncate or rounded.

Clarias fuscus (Lacépède)

Macropteronotus fuscus LACÉPÈDE, 1803, V, p. 88, Pl. II, fig. 2.

Clarias fuscus GÜNTHER, 1864, 'Cat.,' V, p. 18.

Description of a specimen taken February 21, 1923, at Nodoa:

Length to base of caudal 96 mm. Depth in length 5.4; head (to end of bony covering on side) 3.8. Eye in head 9; snout 3; interorbital 2; width of mouth 2.4; width of head 1.4; length of anterior foramen 4; posterior foramen 5; maxillary barbel 0.8; depth of peduncle 4; pectoral spine 2.5; ventral 2.6; caudal 1.8.

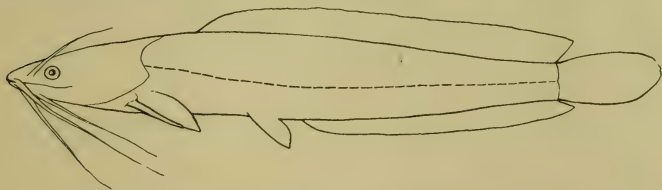


Fig. 3. *Clarias fuscus* (Lacépède). 76 mm. without caudal.

Dorsal about 60; anal about 50.

Head depressed; body compressed; belly flat. Whole top of head and nape smooth and bony beneath the skin, this carapace ending in a vertical limb on the sides, a wide-angled point in the center of nape (separated by an interval slightly less than snout from dorsal origin), and in a horizontal ridge or angle below eye; two well-marked foramina in the central line. Mouth wide, transverse, the upper jaw slightly the longer; lips, chin and flattened base of maxillary barbel papillose; a long barbel at posterior nostril, on maxillary, and two at the side of lower jaw; gill-membranes united at base, free from isthmus, the gill slit ending above at the bony carapace over pectoral base. Pectoral spine short and stout, roughened in front, smooth behind; ventrals passing anal origin; dorsal and anal rays obscure in the fleshy membrane of the fins; vertical fins adnate to caudal at base; anal origin equidistant from base of caudal and center of eye; caudal rather narrow, with straight sides, somewhat rounded behind.

Body and fins uniform dark slaty, paler on the belly. A color sketch from life is uniformly dusky body and fins; that of a smaller specimen dark purplish; the head and fins brownish; blackish horizontal streak below the eye and vertical streak at the base of the caudal.

PARASILURUS Bleeker

BLEEKER, 1862, Versl. Akad. Amsterdam, XIV, p. 394. Type: *Silurus japonicus* Temminck and Schlegel = *Silurus asotus* Linnaeus.

Elongate catfishes with a very small spineless dorsal and no adipose; the anal very long more or less adnate to the subtruncate caudal; only two pairs of barbels.

Parasilurus cochinchinensis (Cuvier and Valenciennes)

Silurus cochinchinensis CUVIER AND VALENCIENNES, 1839, XIV, p. 352, Cochinchina. GÜNTHER, 'Cat.,' V, p. 342.

Description of a specimen (Number 8359, American Museum of Natural History) from Nodda, Hainan:

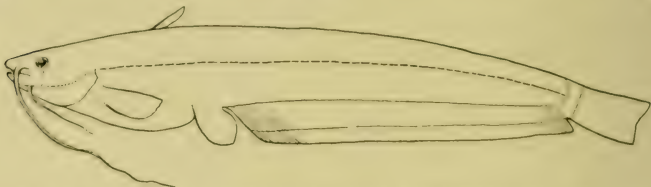


Fig. 4. *Parasilurus cochinchinensis* (Cuvier and Valenciennes). 145 mm. without caudal.

Length to base of caudal 125 mm. Depth in length 4.7; head 5.6. Eye in head 7.5; snout 2.7; interorbital 2.2; maxillary 2; width of mouth 2; maxillary barbel 0.4; width of head 1.4; depth of peduncle 3; pectoral 1.3; ventral 2; longest anal ray 1.7; dorsal 2; caudal 1.1.

Dorsal 5; anal 66.

Head a little depressed; body compressed, breast gibbous, rounded; ventral and anal bases close together. Mouth almost terminal, slightly inferior, wide, curved, transverse, with somewhat pimply lips; maxillary reaching to nearly under center of small eye; which has no trace of a free rim; interorbital broad, slightly convex; gill membranes joined at the base, free from isthmus; dorsal small, without a spine, over the end of pectoral; a little before ventral origin; pectoral spine short pungent concealed, about one-half the length of the fin; pectoral not quite to ventral, ventral reaching past front of anal; last anal ray joined to caudal base for about one-half its length; caudal obliquely subtruncate; very slightly emarginate; no adipose. A long maxillary and single mental barbel, the former reaching to front of anal, the latter to base of pectoral.

Marbled with blackish and paler; caudal and anal dark proximally of two lines which intersect at the tip of the notch between them. A number of specimens of which this is one of the smaller.

The slightly included lower jaw separates this species at once from the widely distributed *Parasilurus asotus* of North and Central China.

We find nothing in the Hainan fish to separate it from *cochinchinensis*, but have no material from Cochin-China, wherewith to compare it.

PSEUDOBAGRUS Bleeker

BLEEKER, 1860, Act. Soc. Sci. Indo-Neerl, VIII, p. 87. Type: *Bagrus aurantiacus* Schlegel.

Moderate or short-bodied catfishes, with four pairs of barbels; the dorsal short; anal of moderate length; caudal well forked; adipose moderate, much smaller than the anal; a strong spine in dorsal and pectoral; eye large or moderate, with a free or partially free rim.

***Pseudobagrus intermedius*, new species**

Close to the widely distributed *Pseudobagrus fulvidraco*; intermediate between that species and one or more related ones on the mainland with short, slender barbels.

DESCRIPTION OF TYPE.—Number 8360, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 106 mm. Depth in length 4.4; head 3.4; Eye in head 5.4; snout 3; interorbital 3; maxillary 3.3; width of mouth

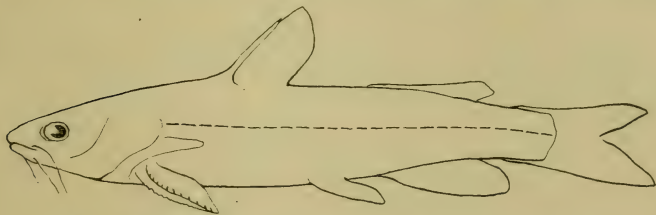


Fig. 5. *Pseudobagrus intermedius*, type. 106 mm., without caudal.

2.5; maxillary barbel 2; width of head 1.5; depth of peduncle 2.6; its length 2.5; dorsal spine 1.8; pectoral spine 1.4; ventral 2; longest anal ray 2.2; lower caudal lobe 1.4; length of adipose 1.9; dorsal interspace 1.2.

Dorsal I, 7; anal 20.

Snout depressed; body behind dorsal compressed; vent about half-way between ventral axil and anal origin. Interorbital flattish; a long depression in the center of the head; bones of the top of head rough striate, not or but thinly covered with skin; backward and forward processes narrowly meeting at nape to form a continuous bony bridge; mouth inferior, curved, with moderately thick slightly striate lips; maxillary reaching not quite to front of eye; barbels normally placed, weak and slender; orbital rim imperfectly free above and below, adnate before and behind; gill-membranes narrowly joined free from isthmus at base. Dorsal origin equidistant from snout and front part of anal or front of adipose; dorsal spine smooth before and behind;

pectoral spine barbed behind, finely serrate in front; both spines striate; a conspicuous rough naked scapular point above pectoral; pectoral not reaching ventral, ventral passing anal origin; caudal well forked, the lower lobe slightly the longer and much the broader.

A darker triangular area on side below dorsal, in front of which a pale band extends downward and forward, and behind which a pale band downward and backward; another slightly dark cross area covering the anterior three quarters of anal; nasal and maxillary barbels dark.

***Pseudobagrus virgatus* (Oshima)**

Aoria virgatus OSHIMA, 1926, Annot. Zool. Japon., XI, p. 4, Kachek River, Hainan.

A small handsome species with round snout, large eye, and unusually sharply marked color pattern, apparently related to but distinct from *Pseudogabrus brachysoma* Günther from Cochin-China.

Description of a specimen (Number 8361, American Museum of Natural History). Locality: Nodoa, Hainan.

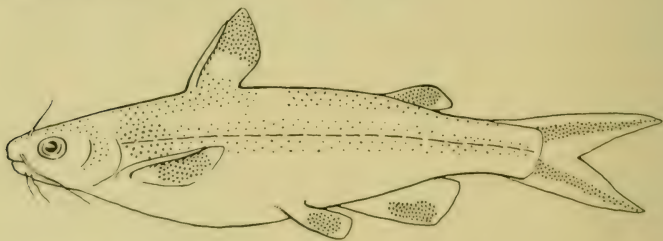


Fig. 6. *Pseudobagrus virgatus* (Oshima). 95 mm., without caudal.

Length to base of caudal 95 mm. Depth in length 3.3; head 3.9. Eye in head 3.8; snout 3; interorbital 2.8; width of mouth 3.4; depth of peduncle 2.2; its length 1.6; maxillary barbel 2; dorsal spine 1.5; pectoral spine 1.3; pectoral fin 1.1; ventral 1.7; longest dorsal ray 1.3; longest anal ray 1.8; caudal lobe 1.1; total length of adipose 1.6; same in dorsal interspace 1.7.

Dorsal I, 7; anal 16.

Well compressed, profile low and slanting, belly rounded; snout blunt and soft; top of head covered with skin; occipital prolongation narrow and long meeting pre-dorsal shield. Mouth inferior, transverse; maxillary not reaching eye; lips rather thick, striate; nostrils far apart; interorbital slightly convex; 4 barbels on each side, one at the front of the posterior nostril, one on maxillary, and two close together on either side of chin; barbels of moderate length and very slender; orbital rim imperfectly free above and in front where there is a deep fold, otherwise adnate; gill-membranes narrowly joined, free from isthmus at base. Dorsal and pectoral spines slender and strong with low barbs behind, smooth in front except one obscure barb

near top of dorsal spine; shoulder spine above basal half of pectoral spine narrow, pointed, exposed, striate, the hollow below it sheathing the pectoral spine. Dorsal origin equidistant from tip of snout and anal origin; ventral origin well behind dorsal base; adipose axil slightly in advance of that of anal; ventrals short and broad, reaching front of anal; caudal well forked with pointed spreading lobes, and rudimentary basal rays keeled. Lateral line bowed slightly up before dorsal, otherwise straight, complete.

Top of dorsal, a large blotch on end of pectoral, another occupying most of the ventral with exception of its base; the adipose excepting its origin and margin, a blotch on the anterior anal rays, and center of caudal lobes black. Vague faint dark shading along the back, broken behind dorsal; and in a band on side from shoulder to base of caudal; otherwise dull pinkish, the fins somewhat yellowish.

GLYPTOSTERNON McClelland

McClelland, 1842, Journ. Nat. Hist. Calcutta, II, p. 584. Type: *Glyptosternon reticulatus* McClelland.

This genus differs conspicuously from *Pseudobagrus* in that the eye is small, more superolateral, without a free rim; the anal is shorter, its base scarcely longer than that of the adipose; the basal portion of the maxillary barbel is furnished with a conspicuous membranous flap adnate to the side of the snout.

Glyptosternon hainanensis, new species

A small *Glyptosternon* with dark spot across each of several fins.

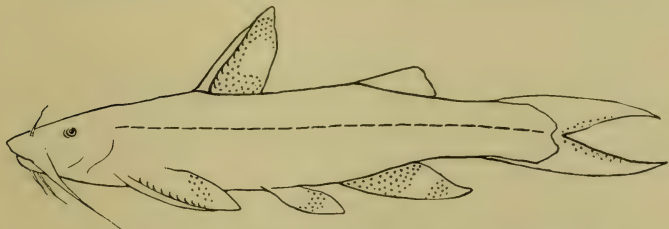


Fig. 7. *Glyptosternon hainanensis*, type. 55 mm. without caudal.

DESCRIPTION OF TYPE.—Number 8362, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 55 mm. Depth in length 4.6; head 3.7. Snout in head 2.2; interorbital 3; width of mouth 2.2; maxillary barbel 1.3; depth of peduncle 2.5; its length (from anal axil) 1.5; pectoral spine 1.2; dorsal spine 1.5; ventral 1.4; longest anal ray 1.4; total length adipose 1.4; dorsal interspace 1.3; caudal lobe 0.8. Eye in snout 4.

Dorsal I, 6; anal 10.

Snout depressed; body at nape triangular; head and breast flat below; body compressed behind the dorsal. Nape rugose striate; with a narrow backward prolongation not quite to the forward point of dorsal shield; eye superolateral; top of head and snout gently and evenly rounding; nasal barbel between the two nostrils which are close together well forward; maxillary barbel adnate at base by a broad membrane; 2 barbels at each side of lower jaw, the outer the larger; mouth inferior, transverse, the lips rather broad; the upper lip and chin slightly papillose; eye without free rim; gill-membranes narrowly joined to isthmus; a narrow pointed exposed spinous scapular process above base of pectoral. Dorsal spine strong, striate, serrate behind; pectoral spine strong, curved, with strong barbs behind; both spines smooth in front. Dorsal origin equidistant from tip of snout and anal origin; pectoral just not reaching to ventral origin, ventral just not to anal origin; caudal strongly forked with narrow pointed lobes, its rudimentary basal rays precurrent keel-like above and below; adipose with conspicuous false rays, narrowly free behind. Texture of skin below dorsal and on sides of head scaly.

Color dark gray, the fins somewhat browner. Dorsal and anal with dark bases, a blackish subterminal mark across the dorsal and anal, and a similar mark nearer the middle of the ventral.

This is apparently well distinguished by the bold, dark markings on the fins from *Glyptosternon majus* (Boulenger) of Borneo, to which it appears to be close. We have compared it with a specimen of *Glyptosternon sinense* from Tungting and with the description and figure of *Pimelodus asperus* McClelland from Chusan, a related fish.

Our only two specimens of *G. hainan* were brought out of the mountains south of Nodoa. It probably does not occur in the vicinity of that town.

COBITIDÆ. Loaches

Loaches are more or less elongate fresh-water fishes related to the carps. Mouth small, inferior, surrounded with barbels in more than two pairs; scales very small or absent; air bladder more or less completely inclosed in a bony capsule; sometimes an erectile spine beneath the eye. They are Eurasian, with center of abundance and variety in the Orient.

The aberrant genus *Gobiobotia* stands somewhat apart from both loaches and carps in an intermediate position between the two. Following the technical characters otherwise convenient to separate the two groups (presence of more than two pair of barbels, air bladder in a bony capsule) it is a loach. In general, however,—short body, comparatively large scales (between 40 and 50), etc.,—it resembles much more closely a gobioid carp, and we are inclined to follow Berg in placing it in the family Cyprinidæ. This decision hinges on our general concept of the history of the loaches, descended from loach-like carps now extinct, somewhat though not very closely related to this relic genus.

Related to the true loaches are several more specialized genera of bottom fishes wherein the front part of the body is depressed, the pectorals and, to a large extent, the ventrals expanded, rounded, placed in a more or less horizontal plane. These are commonly separated in the family Homalopteridæ. But we have seen a fish from Szechwan, China, very close to the genus *Barbatula* of true loaches, which is yet essentially a homalopterid, and we are too impressed with the close relationship of such forms to the other loaches to assign them more than subfamily rank.

Cobitinæ

COBITIS Linnæus

LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 300. Type: *Cobitis tænia* Linnæus.

Elongate, compressed, the head strongly compressed. An erectile spine beneath the eye. Four pairs of barbels about the mouth. Body covered with small scales, the lateral line evident. Caudal truncate or rounded. Sharply marked with lengthwise stripes or rows of blotches. A single widely distributed Eurasian fish more or less separable into geographic forms.

Cobitis tænia Linnæus

Cobitis tænia LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 300.

Cobitis tænia dolichorhynchus Nichols

Cobitis dolichorhynchus NICHOLS, 1918, Proc. Biol. Soc. Wash., XXXI, p. 16, Fukien.

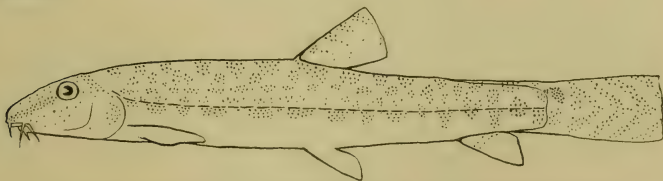


Fig. 8. *Cobitis tænia dolichorhynchus* Nichols. 61 mm. without caudal.

Cobitis tænia from Hainan is so close to material from Fukien with which it has been compared as to be indistinguishable. It appears to differ slightly from *Cobitis biwæ* Jordan and Snyder (1901, Proc. U. S. Nat. Mus., p. 748) of Japan, synonymized with European *C. tænia tænia* by Jordan and Fowler and by Berg. It resembles the European fish, but is quite different from Yangtze material (*Cobitis [tænia] sinensis* Sauvage and De T., 1874-1875, Ann. Sci. Nat., Szechwan) having a

shorter body; shorter peduncle not conspicuously bordered with adipose keels; dorsal origin nearer base of caudal than tip of snout; more sharply marked color pattern in specimens of about 80 mm.

Specimens of 78 to 81 mm. length (to base of caudal) measure as follows. Head in length 4.4 to 4.6; depth 5.5 to 6.0. Eye in head 4.5 to 5; snout 1.9 to 2; depth of peduncle 2 to 2.4; its length 1.7 to 1.9.

Description of a specimen from Nodda, April 3, 1923.—Length to base of caudal 61 mm. Depth in length 5.6; head 4.3. Eye in head 4.5; snout 2.5; depth of peduncle 2.2; pectoral 1.5; ventral 1.6; longest dorsal ray 1.4; longest anal ray 1.6; caudal 1. Interorbital in eye 2; width of mouth 1.5; maxillary barbel 1.

Dorsal 10; anal $7\frac{1}{2}$. Scales before dorsal about 90.

Body compressed; head strongly so. Eye subcutaneous; an erectile spine before its lower anterior corner, with a short secondary basal cusp; mouth inferior, strongly curved; lips thick, the lower occupied by a pair of short thick barbels; longer barbels at the tip and at the side of the maxillary and a pair on the tip of the snout overhanging the mouth in front, the three pairs of about equal length. Gill slit slanting down somewhat backward, terminating below about in front of the first ray of the pectoral. Dorsal origin equidistant from front of eye and base of caudal; pectoral not quite reaching half way to ventral; ventral under middle of dorsal, half-way to anal; caudal truncate, its rudimentary rays precurrent above and below in short, slightly raised fleshy keels.

Some 19 dark spots along the back; about 13 bolder more or less linear blotches along the side; irregular rivulate spotting or streaking between; a dark stripe from eye to snout; cheek speckled; lower parts and lower fins pale. Dorsal spotted; caudal with a short vertical oval ocellate black spot on the upper angle of its base, and about four V-shaped, dark cross-bars.

MISGURNUS Lacépède

LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 16. Type: *Cobitis fossilis* Linnaeus.

Elongate, compressed; no spine about the eye; mouth surrounded with five pairs of barbels; scales small, striate, the lateral line slightly evident in front only; caudal truncate or rounded. Widely distributed in Eurasia, separable into few closely related species and races.

Misgurnus mizolepis Günther

Misgurnus mizolepis GÜNTHER, 1858, Ann. Mag. Nat. Hist., p. 433, Yang-tze.

Misgurnus decemcirrosus FOWLER, 1924, Bull. Amer. Mus. Nat. Hist., III, p. 395.

Misgurnus mizolepis hainan, new sub-species

Plate XXVI, Figure 1

?*Misgurnus psammisus* RICHARDSON, 1846, 'Ich. Chin.,' p. 300, Canton.

DESCRIPTION OF TYPE.—Number 8363, American Museum of Natural History. Locality: Nodda, Hainan, March 16, 1923. Length to base of caudal 83 mm. Depth in length 7.5; head 6. Snout in head 2.6; width of body 1.7; depth of peduncle 1.5; its length 0.8; pectoral 0.9; ventral 1.4; longest dorsal ray 1.3; longest anal ray 1.4; caudal 0.8. Eye in snout 2; interorbital 2; maxillary 1.7; barbel 1.2.

Elongate, moderately compressed; vent almost immediately before anal origin, not more than one-sixth distance to ventral axil. Snout rather blunt; interorbital convex; eye without trace of free rim; mouth inferior horizontal semicircular; lower lip weakly cleft; 3 subequal barbels above, two small ones below the anterior much the smaller; gill cleft slanting a little backward; the gill membranes adnate before the upper pectoral rays. Dorsal origin equidistant from base of caudal and middle of opercle; ventral origin slightly behind that of dorsal; pectoral pointed, extending



Fig. 9. *Misgurnus mizolepis hainan*, type. 83 mm. without caudal.

three-eighths distance to ventral, ventral one half to anal; caudal narrow, rounded subtruncate behind, with well-developed precurrent keels, not fleshy. Scales with close-set horizontal subparallel little radiating striae, embedded in thick slimy skin; short trace of a lateral line behind head only.

Dorsal 9; anal 7. Scales about 150.

Dark along the back, the sides pale with prominent irregular blackish spots, the largest about the size of eye. Black spot at upper caudal base; caudal with narrow irregular blackish barring; dorsal faintly spotted, pectoral and anal slightly marked, ventral pale, unmarked. A color sketch from life is olive on the back, buff beneath; the sides with sharply marked black spots of varying size; the pectoral, dorsal and caudal fins with a few faint specks; the side of the head, a livid bluish with one or two faint lengthwise streaks; the eye red and the barbels banded.

Various authors recognize two distinct loaches of the genus *Misgurnus* from China: the traditional *Misgurnus anguillicaudatus* and *Misgurnus decemcirrosus* (Basil.), which, being unidentifiable, has apparently not always been used for the same form. Fowler (1924, Bull. Amer. Mus. Nat. Hist., III, p. 395) uses *decemcirrosus* for the readily identifiable *Misgurnus mizolepis* Günther. With a rather extensive collection of *Misgurnus* from various parts of China at hand, we find a single distinct form in Hainan. On the basis of the Yang-tze valley material, this is as close to *anguillicaudatus* as to *mizolepis*, but *mizolepis* from Fukien indicates rather clearly that its relationships are with this latter fish.

The diagnostic characters of *Misgurnus mizolepis hainan* are as follows:

Skin more or less thickened and scales more or less embedded; body moderate or elongate, peduncular keels about precurrent caudal rays not fleshy or excessively developed; head small (6 or more in length); dark markings on side contrasted; peduncle long (slightly longer than head); spots on sides irregular, varying in size, some as large as eye; compressed (width of body 2 in head).

Misgurnus mizolepis punctatus Oshima

Misgurnus punctatus OSHIMA, 1926, Annot. Zool. Japon., XI, p. 5. Kacheh River, Hainan.

Depth in length to base of caudal, 6.5; head 6.5. Eye in head 6; snout 2.25; interorbital 4.5; width of head 1.64; pectoral 1.56; ventral 2.40. Dorsal with 8 rays; anal with 7. Scales, about 140. Body elongate, cylindrical, tail compressed. Origin of dorsal much nearer to base of caudal than tip of snout, inserted slightly in advance of the root of the ventrals. Caudal rather short, tip broadly rounded; caudal peduncle deep, its depth 1.28 in head. Sides, cheeks, opercles, and maxillary barbels finely speckled with black; base of the caudal above with no black spot. Length 132 mm.

This loach does not agree with any specimen of *M. m. hainan* we have examined. It may prove to be an intermediate between that and *M. m. fukien* Nichols (1925, Amer. Mus. Novit., No. 169, p. 4).

NEMACHEILUS Van Hasselt

VAN HASSELT, 1823, 'Poissons de Java,' Allgemeine Konst en Letterbok, II, p. 133. Type: *Cobitis fasciatus* Valenciennes.

Small, rather short-bodied loaches with three pairs of long barbels about the mouth: no spine about eye; dorsal of moderate length (about 14); caudal truncate or lunate; nostril in a well-developed tube; scales very small or absent, lateral line complete. Numerous species in southern Asia, etc.

Nemacheilus pulcher, new species

Plate XXVI, Figure 2

A small brightly marked squarish tailed loach.



Fig. 10. *Nemacheilus pulcher*, type. 42 mm. without caudal.

DESCRIPTION OF TYPE.—Number 8364, American Museum of Natural History. Locality: Nodou, Hainan, July 12, 1923. Length to base of caudal 42 mm. Depth in length 1.5; head 3.8. Eye in head 3.5; snout 2.4; interorbital 3; width of mouth 2.5; depth of peduncle, 1.8; pectoral 1.1; ventral 1.4; longest anal ray 1.5; longest dorsal ray 1.4; caudal lobe 0.9.

Dorsal 14; anal 8. Scales about 100.

Moderately compressed, more so posteriorly. Mouth small, inferior, curved, with papillose lips, two central papillæ of upper lip enlarged to small barbels; mouth overhung in front by two pairs of long barbels on the snout, a long maxillary barbel also present; eye with free rim; gill-membranes joining isthmus below base of pectoral; nostril in a rather long tube; conspicuous line of pores from snout below and behind eye, no evident spines on head. Ventral origin a little behind that of dorsal; pectoral not reaching ventral; ventral not reaching anal; caudal subtruncate, its margin slightly concave; its upper precurent rays arched in a low keel. Body with small scales; lateral line complete.

Top of head and back dark; a dark lateral shade comprising small black cross-marks in center of side, larger oval blotches on the peduncle; a black spot on center of caudal base; a few dark blotches along the lower edges of the body from the ventrals to the caudal. Front of dorsal with a black submarginal streak, behind which are broad dark central and submarginal bands; anal with faint marginal and broken central bands; caudal with submarginal streak above and below, and a few spots on its middle rays.

A color sketch from life may be described as follows: ground color pale yellowish; back dusky crossed by five pale bars before the dorsal, and a similar curved pale bar downward from dorsal origin; a dusky shade backward in the middle of the side from the upper angle of the gill-cleft; changing to short blue bars, which extend back to about opposite anal origin, thence about four wider diamond-shaped bars to the middle of the peduncle, and a blue spot in the centre of the caudal base; fins pinkish; the front of the dorsal narrowly blackish and that fin crossed by a central and submarginal dusky band, a central and submarginal dusky band crossing the anal; caudal with submarginal blackish streaks above and below and a narrow dusky submarginal band across the end, dusky-marks in the center.

Homalopterinae

HOMALOPTERA Van Hasselt

VAN HASSELT, 1823, 'Poissons de Java,' Allgemeine Konst. en Letterbok, II, p. 130. Type: *Homaloptera fasciata* Van Hasselt.

Ventrals separate, with 8 to 11 rays; three pairs of barbels, two of which are at front of snout. Numerous species in southern Asia and the Indies.

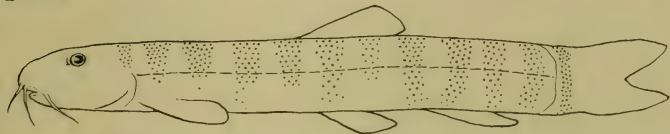


Fig. 11. *Homaloptera fasciolata* Nichols and Pope. 60 mm. without caudal.

Homaloptera fasciolata, new species

DESCRIPTION OF TYPE.—Number 8365, American Museum of Natural History. Locality: Nodoa, Hainan. Length to base of caudal 60 mm. Depth in length 7; head 4.4. Eye in head 6; snout 2.6; interorbital 3.4; maxillary 2.9; width of mouth

2.5; posterior snout barbel 2.7; greatest width (at back of head) 1.4; depth of peduncle 2; its length 1.6; pectoral 1.3; ventral 1.4; longest dorsal ray, 1.5; longest anal ray 1.6; caudal lobe 1.

Dorsal 10; anal 7. Scales very fine, scarcely evident except on sides posteriorly.

Elongate; head depressed; body squarish before dorsal, compressed behind it; peduncle with a low keel above and below confluent with the rudimentary caudal rays; vent slightly nearer anal origin than ventral axil. Lower surface of head, breast and belly flattish; front and sides of head above gently rounded, sloping; outline of snout from above a blunt rounded point; top of head flat, the orbital rim slightly raised; orbit with a free rim; two barbels at each side of the tip of the snout, the posterior slightly longer than a barbel near the tip of the maxillary, and decidedly longer than the anterior. Mouth inferior, transverse, slightly curved; the lips rather full and flaring, free from the jaws; the lower jaw and lower lip eleft; lower end of gill cleft curving downward and backward to terminate below the base of the pectoral. Dorsal origin equidistant from base of caudal and front part of snout; very slightly behind ventral origin; pectoral and ventral reaching a little more than one-half distance to ventral and anal respectively; caudal notched the lower lobe slightly the longer and less pointed.

About eleven more or less obscure broad dark bands across the back and sides; and a narrow blackish bar across caudal base. Dorsal more or less dusky at base and in center; lower fins plain. Of several individuals, the smaller are more sharply marked.

GASTROMYZON Günther

GÜNTHER, 1874, Ann. Mag. Nat. Hist., XIV, p. 454. Type: *Gastromyzon borneensis* Günther.

Body short, flattened below; ventrals with 18 to 21 rays, united to form a suction disk. Few species, East Indian.

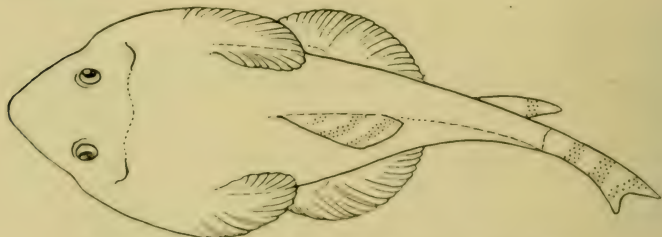


Fig. 12. *Gastromyzon leveretti*, type. 50 mm. without caudal.

Gastromyzon leveretti, new species

A small *Gastromyzon* with barred fins and exerted snout.

DESCRIPTION OF TYPE.—Number 8366, American Museum of Natural History. Locality: Nodoa, Hainan. Length to base of caudal 50 mm. Depth in length

5.6. head 4; pectoral 2.2; ventral 2.8; width between pectoral axils 4; width of ventral disk 2.5. Eye in head 5; snout 2; interorbital 2.2; depth of peduncle 2; its length 2.8; longest dorsal ray 1.4; height of anal 1.5; caudal 1. Width of mouth in snout 2.5; width of gill-cleft 2.6; snout to mouth 3.4.

Dorsal 10; anal 9; pectoral about 30; ventral about 23; scales about 75.

Ventral surface of head and body flat; the bases of the pectorals united with the lower surface of the body to form an oval disk; the ventrals so united to form a circular disk, overlapped by the free ends of the pectorals behind their axils; free end of pectoral 1.4 in its adnate base; tips of ventrals separated behind for about the distal one-third of the last ray; vent equidistant from axil of ventral and origin of anal. Head and body before dorsal depressed, evenly convex; the profile slanting down at an angle of about 45°; peduncle compressed. Mouth entirely inferior; small, semicircular, transverse; upper jaw protractile; a small barbel at the end of the maxillary; several barbels on lower surface of snout overhanging front of mouth; orbital rim free; head with small warty points; largest on edge of snout, small on top of head and on sides back of head. Dorsal origin equidistant from tip of snout and base of caudal; caudal obliquely emarginate, the lower lobe the longer. Lateral line complete, straight, in the center of side; an elongate fleshy flap in the upper axil of the ventral.

Dark olivaceous above; yellowish brown below. Dorsal and caudal barred with black, and anal with one black cross-mark.

Named for Rev. William J. Leverett, of the American Presbyterian Mission of Hainan, who contributed in no small degree to the success of our ichthyological work in Hainan.

Though not found about Nodda, this fish is probably abundant in the mountain streams to the south.

CYPRINIDÆ. The Carps

Carps are the dominant fresh-water fishes of the present day. They reach their greatest development in Asia, particularly southeastern Asia. They are abundant in individuals and species in North America, though less divided into major forms, and are also well represented in Africa; but are absent in South America, which continent it would seem they have not yet invaded. Carps have no teeth in the mouth, but one or more rows of strong well-spaced teeth on the pharyngeal bones. The typical carp is a fish of normal shape; well scaled; a shortish dorsal fin in the center of the back with or without an initial spine; the caudal more or less lunate or forked. Barbels about the mouth may be present or absent, when present definite in position at the sides and end of the maxillary, not more than two pairs.

Aside from a few aberrant forms, inter-relation of the Cyprinidæ is close, but for convenience they may be divided into several series or subfamilies.

The dorsal and anal fins of cyprinid fishes regularly begin with two simple rays, the second, or last simple ray, long, the first short. These two rays figure in our fin-counts, whether (as in some cases) or not they are sufficiently spinous to be designated as spines (in roman). Occasionally a third simple ray or spine may be made out before these two, but this does not figure in the fin counts, even when sufficiently well developed so that it quite naturally would be counted.

Cyprininae

This subfamily is frequently restricted to the aberrant carp (*Cyprinus*) and goldfish (*Carassius*) with long dorsal fin and serrate anal spine, but these have an obvious affinity to *Barbus* and related forms included in the Cyprininae by Weber and de Beaufort (1916, 'Indo-Australian Fishes,' III) and by the present writers also. Whereas the series from *Barbus* through primitive *Labeo* to *Garra* (better known as *Discognathus*) is likely an evolutionary one; supposing *Varicorhinus* and *Xenocypris* in turn to be derivatives of *Garra*, we would accord this phylum or trend with *Garra* as a primitive member subfamily rank, and also separate the gudgeons from the carps proper in like manner.

BARBUS Cuvier

CUVIER, 1817, 'Regne Animal,' 1st Ed., II (Reptiles, Fishes, etc.), p. 192. Type: *Cyprinus barbus* L.

This large genus is most diversified in the warmer parts of Asia, in Africa, and the Indies. Its type species, however, is a comparatively fine-scaled fish from Northern Europe. *Barbus* has been split into many genera differing but slightly. The aims of nomenclature would seem to be best served for the present by leaving its multitude of closely related species in the genus *Barbus* and recognizing a comparatively few main divisions as subgenera.

Symmetrical free-swimming forms for the most part of small or moderate size; mouth normal or slightly specialized, terminal or somewhat inferior, with two pairs of barbels, occasionally reduced to one pair or absent; scales moderate or large; dorsal short with or without an initial spine (present or absent in otherwise closely related forms) which is frequently serrate when present, caudal forked; no anal spine. Vent situated immediately before anal origin.

Subgenus **SPINIBARBUS** Oshima***Barbus denticulatus*, (Oshima)**

Barbus putitora McCLELLAND, 1844, Calcutta Journ. Nat. Hist., IV, p. 399, fig.; not *B. putitora* Hamilton-Buchanan. *Spinibarichthys denticulatus* Oshima, 1926, Annot. Zool. Japon., XI, p. 11. Kachek River, Hainan.

Description of a specimen (Number 8388, American Museum of Natural History). Locality: Nodda, Hainan.

Length to base of caudal 85 mm. Depth in length 3; head 3.7. Eye in head 3.3; snout 3.5; interorbital 2.5; maxillary 2.9; posterior barbel 3; depth of peduncle 2; its length 1.9; pectoral 1.1; ventral 1.4; longest dorsal ray 1.1; longest anal ray 1.4; caudal lobe 0.8.

Dorsal II, 9; anal 8. Scales 29. Teeth 3-rowed, 5, 3 or 4, 2; stout, slightly hooked.

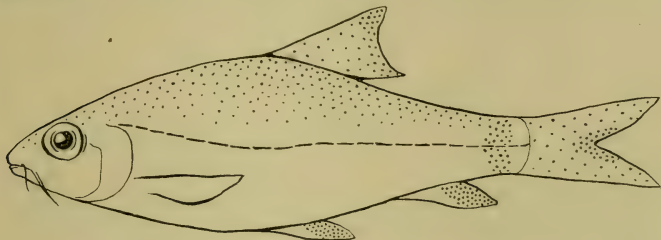


Fig. 13. *Barbus denticulatus* (Oshima). 85 mm. without caudal.

Compressed. Interorbital flat; snout rather pointed; extending slightly beyond the inferior horseshoe-shaped mouth; maxillary protractile; upper lip with cross striæ; the lower free in front; 2 barbels, the posterior decidedly the longer; gill-membranes narrowly joined to isthmus under edge of preopercle. Last simple dorsal ray a slender spine in its basal part, with a soft tip (heavier and finely serrate behind in larger specimens); dorsal origin equidistant from base of caudal and front of eye; over ventral base; pectoral extending three-quarters the distance to ventral; ventral two-thirds the distance to anal; caudal forked with narrow pointed lobes. Scales rough, with radiating striæ; lateral line complete, dropping a little over pectoral, thence running straight, below the center but rising on peduncle and terminating in center.

Dark gray above, the scales narrowly dark-edged, and ill-defined streaks following their centers lengthwise the fish; lower surfaces pale; a vague dark blotch on peduncle at base of caudal; dorsal more or less dusky, its last rays tipped with whitish; pectoral pale; ventral and anal black distally, margined with whitish at the inner corner; caudal grayish, dusky on tips and in notch.

Barbus nigrodorsalis (Oshima)

Spinibarbus nigrodorsalis Oshima, 2926, Annot. Zool. Japon., XI, p. 10. Kachek River, Hainan.

A large-scaled *Barbus*, two pairs of barbels, dorsal black-bordered.

Description of a specimen (Number 8367, American Museum of Natural History). Locality: Nodoo, Hainan, April 23, 1923.

Length to base of caudal 115 mm. Depth in length 4.1; head 3.6. Eye in head 4; snout 3; interorbital 2.7; maxillary 3.5; posterior barbel 3.5; anterior barbel 5; depth of peduncle 2.5; length of peduncle 2.5; pectoral 1.5; ventral 1.6; longest dorsal ray, 1.8; height of anal 1.9; caudal lobe 1.1.

Dorsal 11; anal 7. Scales 20 (last on base of caudal). Teeth 3-rowed, 5, 3, 2; with narrow pointed tips; slightly bent, the main teeth stout.

Head broad, flat-topped, blunt; mouth horizontal, lower jaw slightly the shorter; two slender maxillary barbels; gill-membranes joined to the isthmus;

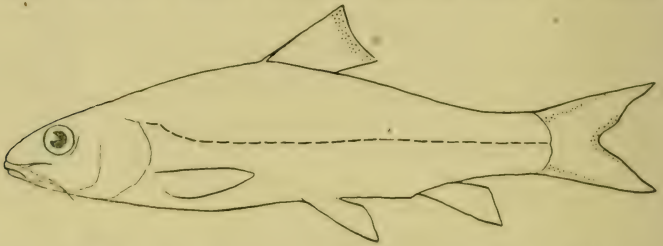


Fig. 14. *Barbus nigrodorsalis* (Oshima). 115 mm. without caudal.

patch of small horny warts on right preorbital; maxillary to under front margin of eye. Last simple ray of dorsal not enlarged or spiny; ventral under center of dorsal; pectoral not reaching ventral; ventral not reaching anal. Lateral line complete; scales roughened with close-set subparallel horizontal striae.

Dark along the back; scales of sides with dark outlines; belly and lower fins pale; dorsal with conspicuous black upper posterior border; caudal with submarginal dusky streak on the lobes basally, and faint dusky edge in the notch. A color sketch from life is silvery; greenish on the top of head and on the back; scales of back and sides narrowly margined with dark; pectoral, dorsal and caudal fins greenish, the dorsal with a black margin; the caudal with sub-marginal dusky streak above and below; its tips tinged with orange as also the distal portion of the dorsal next to the black margin; ventral and anal fins orange.

Subgenus PUNTIUS Hamilton-Buchanan**Barbus semifasciolatus** Günther

Barbus semifasciolatus GÜNTHER, 1868, 'Cat.,' VII, p. 484.

Description of a specimen from Nodoo, Hainan, March 6, 1923:

Length to base of caudal 34 mm. Depth in length 2.6; head 3.2. Eye in head 2.8; snout 3.8; interorbital 2.5; maxillary 4; depth of peduncle 1.7; its length 1.7; pectoral 1.6; ventral 1.6; longest dorsal ray 1.6; longest anal ray 2; caudal lobe 1.2; barbel in eye 1.7.

Dorsal II, 8; anal 8. Scales 24.

Body deep and compressed. Lower jaw slightly included; mouth small oblique; maxillary not reaching front of orbit, with a single short subterminal barbel; gill-

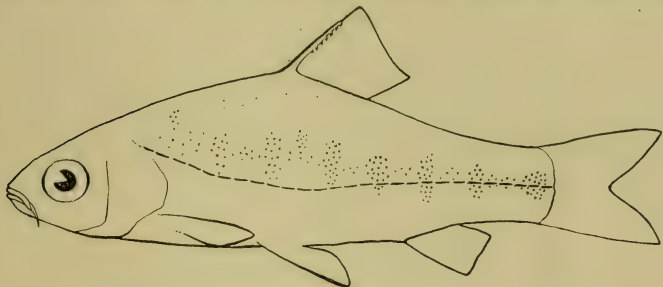


Fig. 15. *Barbus semifasciolatus* Günther. 34 mm. without caudal.

membranes narrowly joined to isthmus. Ventral origin under that of dorsal; pectoral just reaching ventral; ventral not reaching anal; last simple ray of dorsal a slender spine with barbs behind terminally. Body covered with thin cycloid scales with radiating striae; lateral line complete, little depressed, running in the center of the peduncle.

A series of short black bars along middle of side; scales of back and sides edged with dusky. A color sketch from life is olive silvery on the sides, lower parts red; several narrow black bars in the middle of the sides and a black spot at the base of the caudal; fins tinged with red.

This brilliantly colored little fish was common in the many small, grass-grown irrigation reservoirs and ditches of the rice fields about Nodoo. It is hardy, and very variable in color.

Subgenus **LISSOCHILICHTHYS** Oshima

Barbus barbodon, new species

DESCRIPTION OF TYPE.—Number 8368, American Museum of Natural History. Locality: Nodoo, Hainan. Length to base of caudal 193 mm. Depth in length 3.5; head 4.3. Eye in head 5.2; snout 2.5; interorbital 3; maxillary 3.1; greatest width of body 1.9; depth of peduncle 2.2; its length 1.6; pectoral 1.2; ventral 1.3; longest dorsal ray 1.1; longest anal ray 1.2; caudal lobe 0.8. Posterior barbel 1.3 in eye.

Dorsal II, 8½; anal 7½. Scales 41. Teeth 3-rowed, 5, 3, 2, pointed, the tips little bent.

Compressed. Interorbital gently convex; snout pointed, extending a little beyond the inferior slightly oblique mouth; lower jaw with a free tip with horny sheath, projecting beyond the lip the front margin of which is notched in the center; maxillary not nearly to under front of eye; with 2 small barbels, the posterior decidedly the larger; gill-membranes broadly joined to side of breast behind the edge of the preopercle. Last simple ray of dorsal a broad spine with row of sheathed barbs on each

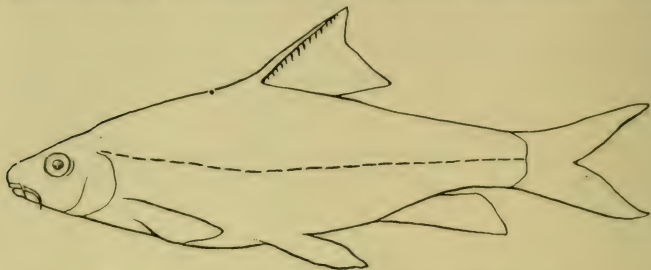


Fig. 16. *Barbus barbodon*, type. 193 mm. without caudal.

side behind, but with a soft tip. Dorsal origin equidistant from tip of snout and posterior part of peduncle; ventral origin slightly behind that of dorsal; pectoral reaching two-thirds the distance to ventral; ventral four-sevenths to anal; anal to caudal base; caudal well forked with pointed equal lobes, the lower the broader. Scales rough with close spaced slightly radiating striae, subparallel in the center of the scale; lateral line complete, very slightly bent down, in the center of peduncle.

Color darkish, uniform; caudal narrowly margined with blackish behind, especially the lower lobe; and blackish on the membranes of the dorsal.

Two other specimens were obtained.

***Barbus matsudai* (Oshima)**

Lissuchilichthys matsudai OSHIMA, 1920, Proc. Acad. Phila., LXXII, p. 121, Pl. III, fig. 2. Formosa.

Oshima (1926) refers to *Barbodes paradoxus* (Günther) a fish from the Kachek River, which seems to us rather to belong with this species which we have in abundance from Fukien province.

Length 55 mm. Sides with vertical black bands. Depth, 3.75; head 4.10. Eye in head 2.75. Dorsal with 10 rays; anal with 7. Scales 40.

CYCLOCHEILICHTHYS Bleeker

BLEEKER, 1859, Nat. Tijdschr. Ned.-Ind., XX, p. 431. Type: *C. armatus* Bleeker.

This genus resembles four-barbelled barbs of the subgenus *Lissuchilichthys*, and perhaps represents a further development of the same

trend or phylum. The mouth is conspicuously inferior and somewhat peculiar, lips are connected around the corner of the mouth. An initial serrate dorsal spine. Species of the East Indies and southern China.

***Cyclocheilichthys iridescens*, new species**

Barbels not fringed; end of tubes of scales of lateral line simple, not bifid; eye 1.5 in postorbital part of head; 16 scales around caudal peduncle; 4 scales between ventrals and lateral line. With finer scales than any East Indian species.

DESCRIPTION OF TYPE.—Number 8369, American Museum of Natural History. Locality: Nodoa, Hainan. Length to base of caudal 102 mm. Depth in length 3.3; head 4.1. Eye in head 3.8; snout 2.8; interorbital 2.8; maxillary 5; posterior barbel 4.2; depth of peduncle 2.5; its length 1.6; dorsal spine (with filamentous tip) 1; pectoral 1.1; ventral 1.2½; longest anal ray 1.2½; caudal lobe 0.9.

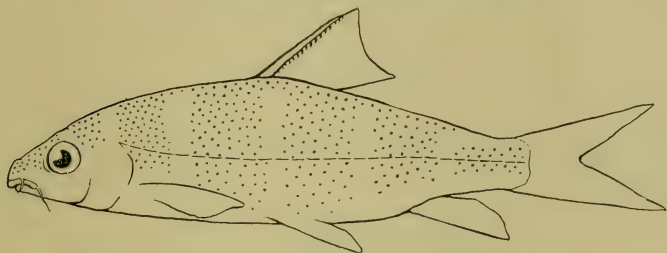


Fig. 17. *Cyclocheilichthys iridescens*, type. 102 mm. without caudal.

Dorsal II, 8; anal 7. Scales 42. Teeth 3-rowed, 4, 3, 2; more or less blunt or imperfectly truncate.

Elongate, moderately compressed, back slightly elevated, breast narrowly rather flat. Snout rather pointed. Mouth small, inferior, horseshoe-shaped, horizontal; maxillary protractile, not reaching eye; with 2 slender barbels, the posterior subterminal, decidedly the longer; lips thick, slightly grooved, crossing the base of the mandible, the narrow fused shank of which extends beyond the lip to a somewhat spatulate end which is striate above (inside), the end of the lower jaw thus resembling condition in *Chilogobio*; gill-membranes joined to breast behind the margin of the preopercle. Dorsal origin equidistant from tip of snout and base of caudal; slightly in advance of that of ventral; front of dorsal with a strong spine, serrate behind, which has a soft filamentous tip forming the apex of the fin; pectoral not reaching ventral, ventral not reaching anal, anal almost to caudal base; caudal strongly forked with pointed equal lobes. Scales rough, with subparallel or slightly radiating striae; lateral line complete, straight, in center of peduncle.

Above dark, belly pale; scales of sides more or less margined with (or with marginal bars of) dark; 4 or 5 broad dark shades across sides with narrow paler interspaces; fins plain.

OSTEOCHILUS Günther

GÜNTHER, 1868, 'Cat.,' VII, p. 40. Type: *Rohita melanopleura* Bleeker.

Two pairs of barbels; mouth inferior with expanded conspicuously striate lips, the upper confluent with the lower; dorsal rather long, without a spine; scales of moderate size.

***Osteochilus salsburyi*, new species**

Peduncle surrounded by 16 scales; eye above the level of the upper lip; several (varying in number and distinctness) very small indentations on snout, each at times provided with a minute tubercle, no conspicuous pores. Between ventral and lateral line $4\frac{1}{2}$ series of scales; $6\frac{1}{2}$ series below lateral line before ventral; 6 series between lateral line and dorsal. Depth of peduncle 1.3 in its length.

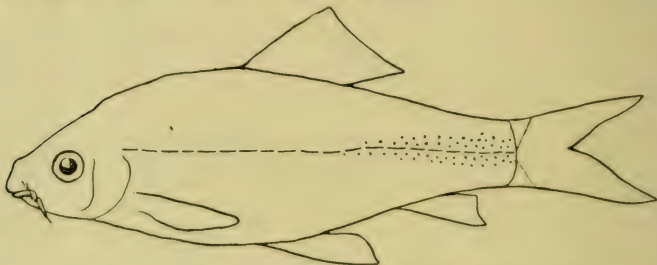


Fig. 18. *Osteochilus salsburyi*, type. 85 mm. without caudal.

DESCRIPTION OF TYPE.—Number S371, American Museum of Natural History. Locality: Nodda, Hainan.* Length to base of caudal 85 mm. Depth in length 3.1; head 4. Eye in head 3.9; snout 2.5; interorbital 2; maxillary 3; width of mouth 3.5; maxillary barbel 4.5; depth of peduncle 1.9; its length 1.5; pectoral 1.1; ventral 1.3; longest dorsal ray 1.3; longest anal ray 1.5; caudal lobe 0.8.

Dorsal 13; anal $7\frac{1}{2}$. Scales 34.

Compressed; head broad and blunt. Mouth inferior transverse horizontal horseshoe-shaped, very slightly behind tip of snout; overhung squarely in front by the thick free vertical snout membrane; lower jaw broad and squarish at the end; lips thick fringed striate-papillose, the lower broadly free in front, confluent with chin behind; a barbel at the corner of the snout membranes and subterminally on the maxillary, the latter decidedly the longer; interorbital convex; gill-membranes broadly joined to side of breast behind edge of preopercle. Dorsal and anal without spinous rays; dorsal origin equidistant from tip of snout and anal axis; ventrals situated before the center of dorsal base; pectoral reaching $\frac{2}{3}$ the distance to ventral; ventral $\frac{3}{4}$ to anal; caudal well forked with bluntly pointed equal lobes. Scales rough, with conspicuous close-spaced subparallel horizontal striae; lateral line complete, straight, in the center.

Color dark, paler on opercle and lower surfaces; a dark central longitudinal band on peduncle faintly indicated; sides with obscure blackish bars on the scale tips.

Apparently slightly different from *Osteochilus vittatus* (Cuvier and Valenciennes, 1842) from Borneo, Java, Sumatra, Tonkin, which is described as having 3 conspicuous pores on snout; and also close to *Osteochilus brachynotus* (Bleeker, 1855) from Sumatra. See Weber and de Beaufort, 1916, III, pp. 124-141, for an analysis of this finely divided genus.

Named for Dr. Clarence G. Salsbury, of the American Presbyterian Mission of Hainan, in appreciation of his interest and aid in the work.

A number of specimens. An unusually large one (155 mm. to base of caudal) has 3 small warts in a triangle in center of snout somewhat larger than the others of 20 or so scattered ones.

This is probably what Oshima (1926) has identified with *Osteochilus brachynotus* (Bleeker) of Sumatra.

CYPRINUS Linnæus

LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 320, after Artedi. Type: *Cyprinus carpio* Linnæus.

Anal as well as dorsal with a serrate spine; dorsal long (rarely shorter); two pairs of barbels (rarely one pair); teeth in 3 rows, molar-like.

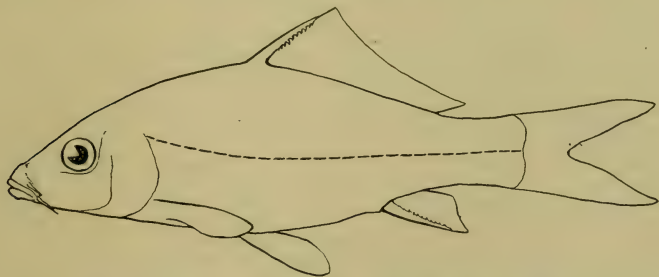


Fig. 19. *Cyprinus carpio* Linnæus. 122 mm. without caudal.

Cyprinus carpio Linnæus

Cyprinus carpio LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 320.

Description of a specimen from Nodoo, Hainan:

Length to base of caudal 120 mm. Depth in length 3; head 3.2. Eye in head 4.3; snout 2.6; interorbital 3; maxillary 3.4; maxillary barbel 5.5; depth of peduncle 2.4; its length 2; pectoral 1.5; ventral 1.6; longest dorsal ray 1.7; longest anal ray 1.7; caudal lobe 1.

Dorsal II, $20\frac{1}{2}$; anal II, $5\frac{1}{2}$. Scales 35.

Compressed. Interorbital a little convex; snout pointed; lower jaw very slightly included; mouth horizontal; maxillary not nearly to under front of eye; with 2 barbels, the terminal somewhat the longer; gill cover with faint striae, radiating downward and backward; gill-membranes joined to sides of isthmus under edge of preopercle. Dorsal and anal with stout spines, barbed behind, that of the dorsal strongly, of the anal weakly so; the dorsal especially with a soft tip; axils of dorsal and anal apposed; dorsal origin equidistant from tip of snout and base of caudal, over center of ventral base; pectoral and ventral rounded; pectoral passing ventral origin; ventral reaching two-thirds distance to anal; caudal well forked with broad pointed lobes. Scales rather rough with faint radiating striae; lateral line complete, slightly bent down, in the center of peduncle.

Dark; scales with narrow dark edges; paler on lower surfaces; fins dusky. Several specimens of which this is one of the smaller.

CARASSIUS Nilsson

NILSSON, 1832, 'Prodromus Ichthyologiæ Scandinaviæ,' IV, p. 290. Type: *Cyprinus carassius* L.

Anal as well as dorsal with a serrate spine; dorsal long; no barbels; teeth in one row, compressed.

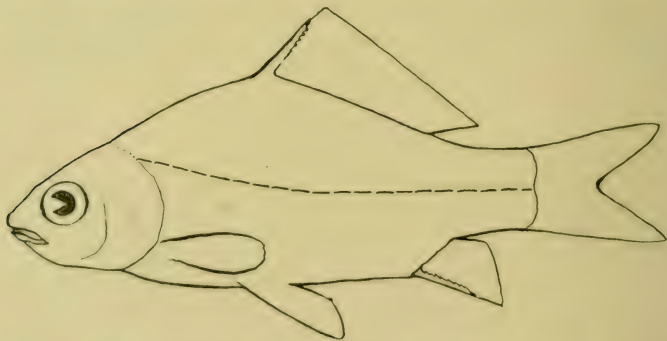


Fig. 20. *Carassius auratus* (Linnæus). 83 mm. without caudal.

Carassius auratus (Linnæus)

Cyprinus auratus LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 322.

Description of a specimen from Nodoo, Hainan:

Length to base of caudal 80 mm. Depth in length 2.4; head 3.2. Eye in head 3.6; snout 3.6; interorbital 2.7; maxillary 3.2; pectoral 1.5; ventral 1.4; caudal lobe 1; dorsal spine 1.6; anal spine 1.8; depth of peduncle 1.8.

Dorsal II, 18; anal II, $5\frac{1}{2}$. Scales 29.

Mouth small, lower jaw slightly the shorter. First spine of dorsal and anal rudimentary, the last stout and serrate behind. Pectoral reaches front of ventral, ventral not to anal. Color brownish.

Description (for comparison) of a small specimen from Tungting Lake, Hunan, December 25, 1921. Length to base of caudal 99 mm. Depth in length 2.4; head 3.6. Eye in head 3.4; snout 3; interorbital 2.5; maxillary 3.1; pectoral 1.5; ventral 1.3; caudal lobe 1; dorsal spine 1.6; anal spine 1.7; depth of peduncle 1.7.

Dorsal II, 20; anal II, 5. Lateral line 28.

Mouth small, jaws equal. First spine of dorsal and anal rudimentary, the last stout and serrate behind. Pectoral reaches front of ventral, ventral not to anal. Color brownish.

In life the upper margin of the Hainan gold-fish's eye is red. In this respect Hainan examples differ from the northern ones.

Gobioninae¹

The gudgeons are a numerous and variable Eurasian group or series tending towards elongate forms, strictly inferior mouth with free, more or less papillose or striate lips, vent placed well forward towards ventral axil, small scales, naked breast. They are characterized by a single, well-developed pair of barbels at the end of the maxillary, rarely absent, and we know of no case where the anterior pair, characteristic of the Cyprininae, is present. The dorsal spine, the presence or absence of which is of so little moment in the Cyprininae, is with the Gobioninae present only in the aberrant genus *Hemibarbus* (and *Acanthogobio*), where it is strong and smooth. *Hemibarbus* is placed outside this group and close to *Barbus* by some authors. The above-mentioned gobion tendencies are variously present or absent in each of the many species and form an unsatisfactory basis for their separation into genera. The most primitive gudgeons, if they stood alone, might well enough be classed with the Cyprininae.

¹While this paper is in press several specimens of a minnowlike gudgeon from Nodda have been referred to the genus *Gnathopogon* as follows:

Gnathopogon atromaculatus, new species

Length to base of caudal (of type, No. 8442, Amer. Mus. Nat. Hist.) 54 mm. Depth in length 4.2; head 3.5. Eye in head 2.8; snout 3.5; interorbital 3.4; maxillary 3.7; width of mouth 3.3; barbel 3; width of body (at shoulder) 2; depth of peduncle 2.6; its length 1.5; pectoral 1.5; ventral 1.7; longest dorsal ray 1.3; longest anal ray 1.7; caudal lobe 1.

Dorsal 9; anal 8. Scales 36.

Moderately compressed; breast and belly rounded; vent at $\frac{3}{4}$ the distance from anal origin to ventral axil. Interorbital slightly concave; eye large, oval, slightly superolateral; snout broad, sharp, soft (apparently an age character); upper jaw protractile; maxillary slightly oblique not reaching to under front of eye; lower jaw without free lip, distinctly included; a subterminal barbel, very slender distally; gill-membranes joined to isthmus under posterior margin of eye. Dorsal and anal without spinous rays; dorsal origin slightly nearer tip of snout than tip of depressed anal; pectoral reaching more than $\frac{2}{3}$ the distance to ventral; ventral $\frac{2}{3}$ to anal; caudal well forked with narrow pointed lobes. Scales thin; body completely scaled; lateral line complete, dipping slightly in front, in the center of peduncle.

Pale. Some black marking along base of dorsal, particularly a black spot at its origin; a faint dark stripe in the center of peduncle, rising above lateral line over ventral; a short dark stripe behind the vent; a faint dark shade at the base of each caudal lobe. Smaller specimens have the scales of back slightly outlined in dark, peduncular stripe bolder, marking along lateral line as in *G. wolterstorffi* sometimes faintly indicated. The spot at dorsal origin is constant.

Though an indefinite group baffling definition, the Gobioninæ as here understood (with the exception of *Sarcocheilichthys*, which we have been tempted to place in the Cyprininæ) may be rather easily referred to two or three parallel basally approximate phyla. The forms are most numerous in central China but do not extend into the Indies and apparently form a much smaller part of the Hainan fauna than of the fauna at any point on the mainland to the north.

SARCOCHEILICHTHYS Bleeker

BLEEKER, 1859, Nat. Tijdschr. Ned. Ind., XX, p. 435. Type: *Leuciscus variegatus* Temminck and Schlegel.

The type of *Sarcocheilichthys* is Japanese. In dealing with related mainland forms, Berg retains *Sarcocheilichthys* for *S. sinensis* and its allies, and proposes *Chilogobio* Berg for the others. But *S. variegatus* appears to be more closely related to *Chilogobio* than to *S. (sinensis) lacustris* figured by him. We believe that three subgenera should be recognized including *Barbodon* Dybowski with *Barbodon lacustris* Dybowski as type.

Subgenus **CHILGOBIO** Berg

BERG, 1914, 'Faune de la Russie, Poissons,' III, part 2, p. 488. Type: *Chilogobio solitator* Berg = *Georgichthys* NICHOLS, 1918, Proc. Biol. Soc. Wash., XXXI, p. 17.

Small fishes with a general resemblance to *Barbus*. No barbels; mouth small, somewhat inferior; lower jaw with a narrow shaft, expanded at the tip, conspicuous lips stopping at its sides. Vent in an intermediate position between ventral axil and anal origin. Scales about 40, lateral line complete, straight, in the center; a single row of pharyngeal teeth. Several closely related forms in eastern Asia.

This subgenus is closely related to *Barbodon* (subgenus) which has a more gobioninoid form, a minute barbel at the end of the maxillary, and horny tip to the lower jaw, and it has likely at times been mistaken for the young of same. We had in mind the possibility of its being such until convinced of its distinctness by comparable material (same size) of each from Tungting Lake, Yang-tze.

Sarcocheilichthys hainanensis, new species

Plate XXVI, Figure 3

DESCRIPTION OF TYPE. — Number 8370, American Museum of Natural History. Locality: Nodda, Hainan, July 28, 1923. Length to base of caudal 62 mm. Depth in length 4.0; head 4.0. Eye in head 3; snout 3; interorbital 3; maxillary 3.7; length of peduncle 1; depth of peduncle 1.8; pectoral 1.1; ventral 1.3; longest dorsal ray 1; longest anal ray 1.5; caudal lobe 1.

Dorsal 9; anal 9; scales 40.

Body moderately compressed. Mouth protractile, small, curved, inferior, with thick smooth lips, those of the lower jaw at base only, completely separated by narrow shaft and expanded tip of same; maxillary barely reaching front of orbit; gill-membranes united to isthmus, distance between the slits less than half eye. Dorsal with its anterior rays neither stiffened nor thickened; center of its base equidistant from front of eye and base of caudal; pectoral extending not quite to ventral; ventral falling far short of anal, and anal of caudal; ventral inserted a little behind dorsal origin; caudal well forked. Scales with somewhat roughened surface and close-set parallel or subparallel horizontal striæ; lateral line complete.

Dark along back and irregularly dark along middle of side, with an elevated dark blotch or area under dorsal; dorsal with a black vertical streak in front and behind; caudal with black stripes in center of lobes; ventral and anal with broad black central cross-blotches, and pectoral with a fainter linear black spot along the upper edge. A

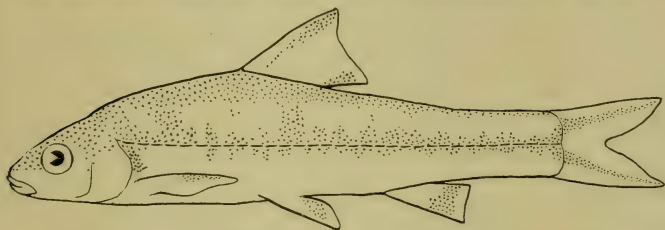


Fig. 21. *Sarcocheilichthys hainanensis*, type. 62 mm. without caudal.

color sketch from life is as follows: midline of back dusky, sides straw-yellow, lower parts silvery white; a narrow dusky stripe in the middle of the side from the head to the base of the caudal fin, scattered scales along this stripe and irregularly above it especially below dorsal, black; fins pale, the front, and posterior corner of the dorsal, center of caudal lobes, band across ventral and anal and a rather faint mark along upper pectoral rays, black.

This is a rare fish about Nodoa. We saw only three or four examples: one was taken in the small stream that rises just northeast of Nodoa.

Chilogobio appears to be one of the commonest and most widely distributed groups of small fishes in China. Berg has given an analysis of the genus (subgenus) wherein he recognizes six forms: *czerskii* Berg, Lake Chanka; *soldatovi* Berg, Amur; *sciistius* (Abbott), Chihli; *nigripinnis* (Günther), Shanghai; *imberbis* (Sauvage and De Thiersant), Shensi; *nitens* (Günther), Shanghai. From the type description of *nitens* we are convinced that it is not a closely related fish, and should be excluded from *Chilogobio* and *Sarcocheilichthys* altogether. On the other hand, *scaphignathus*, type of the genus *Georgichthys* Nichols (1918, Proc. Biol. Soc. Wash., XXXI, p. 17), is a *Chilogobio*. In addition to

nigripinnis from Anhwei, *scaphignathus* from Fukien, and the present species, Hainan, our Chinese collections contain another undescribed form from Tungting Lake, middle Yang-tze, so comparatively closely allied to *soldator* and *sciistius* on the one hand and *nigripinnis* on the other that the four may best be considered subspecies. This Yang-tze fish may stand as follows.

***Sarcocheilichthys nigripinnis tungting*, new subspecies**

DESCRIPTION OF TYPE.—Number S357, American Museum of Natural History. Locality: Huping, Tungting Lake, Hunan. Length to base of caudal 80 mm. Depth in length 3.9; head 4. Eye in head 4; snout 3.5; interorbital 3; maxillary 3.3; width of mouth 4; width of body 1.8; depth of peduncle 2; its length 1.5; pectoral 1.4; ventral 1.6; longest dorsal ray 1.1; longest anal ray 1.7; caudal lobe 1.1.

Dorsal 9; anal 8. Scales 42.

Moderately compressed; the back somewhat elevated; breast broadly rounded; vent a little nearer anal origin than to ventral axil. Interorbital flattish, very slightly convex; snout bluntly pointed; mouth nearly horizontal, transverse, curved; upper jaw protractile; lower jaw included; maxillary not reaching to under front of eye; no barbels; sides of snout and cheeks with small scattered, poorly developed warty prominences; gill-membranes broadly joined to isthmus behind edge of preopercle. Dorsal and anal without spinous rays; dorsal origin equidistant from snout and anal axil; ventral origin under center of dorsal base; pectoral rounded, not reaching ventral, ventral not reaching anal; caudal moderately forked with bluntly pointed lobes. Scales rough with subparallel slightly radiating striae; lateral line complete, in center, rising very slightly to meet opercle.

A black oblique bar immediately behind opercle; sides with many irregular dark cross blotches, and slight tendency for these to form a lateral stripe. Fins dusky grayish more or less uniform, the ventral and anal darker with pale edges.

A number of specimens, of which the type is one of the largest. Smaller ones have a definite blackish lateral stripe; one of 50 mm. colored much as typical *nigripinnis* from Anhwei but in most the fins are more uniform. *Barborodon* from the same locality compared down to a smaller size than this specimen, readily separated from it by blunter head, less compressed body, horny tip of lower jaw, small barbel, and different color.

Pseudogobio maculatus Günther (1888, Ann. Mag. Nat. Hist., p. 432) from farther up the Yang-tze seems to be a *Chilogobio*, not a *Barborodon* as supposed by Berg; but, from color, close to *czerskii* and *scaphignathus* rather than the *nigripinnis* group.

Analysis of *Chilogobio*

1.—Slender (depth less than head); ventral under first third versus middle of dorsal.
S. (Chilogobio) imberbis (Sauvage and De Thiersant).

Not as above. 2.

2.—Lower fins pale, unmarked; scales 39 to 40; depth 3.7 to 3.8; eye 3.4 to 3.6; length of peduncle 1 to 1.1; dark mark on front of dorsal, dark center to caudal lobes. Ventral origin before center of dorsal base. 3.

Lower fins grayish, dusky, or largely occupied by blackish blotches; scales 38 to 42; depth 3.9 to 4.2; eye 3.7 to 4; length of peduncle 1.1 to 1.7; dorsal dusky more or less darker before and behind, or with extensive black marks before and behind and a pale center; marks on caudal lobes obscure or absent. Ventral origin about under center of dorsal base.

S. (Chilogobio) nigripinnis (Günther).....4.

Body and fins pale with sharp blackish marks, such on front and back of dorsal, center of lower fins, center of caudal lobes; scales 40; depth 4; eye 3; length of peduncle 1. Ventral origin before center of dorsal base.

S. (Chilogobio) hainan Nichols and Pope.

3.1—Mouth slightly oblique; pectoral 1.4.....*S. (Chilogobio) czerskii* Berg.

Mouth horizontal; pectoral 1.....*S. (Chilogobio) scaphignathus* (Nichols).

4.—Length of peduncle 1.1; scales 39 to 41; depth 4 to 4.2; dorsal dusky; body dark with conspicuous blackish bar behind head.....*S. (C.) n. soldatovi* Berg.

Length of peduncle 1.3 to 1.5; scales 38 to 42; depth 3.9 to 4.5; dorsal darker before and behind; body dark with more or less conspicuous blackish bar behind head.....5.

Length of peduncle 1.7; scales 38; depth 4.1; dorsal black before and behind; pale in center; lower fins largely covered with dark blotches.

S. (C.) n. nigripinnis (Günther).

5.—Dorsal origin equidistant from tip of snout and middle of peduncle; depth 4 to 4.5; scales 38 to 40; length of peduncle 1.3; pectoral 1.3.

S. (C.) n. sciistius (Abbott).

Dorsal origin equidistant from tip of snout and anal axil; depth 3.9; scales 42. length of peduncle 1.5; pectoral 1.4....*S. (C.) n. tungting* Nichols and Pope.

HEMIBARBUS Bleeker

BLEEKER, 1859, 'Conspectus syst. Cyp.,' Nat. Tijdschr. Ned.-Ind., XX, p.

431. Type: *Gobio barbatus* Temminck and Schlegel.

Moderately elongate, head below and breast moderately flattened; tip of snout somewhat expanded, with a dent behind it; eye large, placed high, very slightly superolateral; mouth inferior, with thick lips; a single pair of barbels at the end of the maxillary; vent immediately before anal origin; dorsal with a long stout smooth spine. Teeth 3-rowed, 5, 2 or 3, 1.

Hemibarbus labeo (Pallas)

Cyprinus labeo PALLAS, 1776, 'Reise,' III, pp. 207, 703.

Description of a specimen from Nodoo, Hainan:

Length to base of caudal 131 mm. Depth in length 4.3; head 3.3. Eye in head 4; snout 2.3; interorbital 4; maxillary 2.7; dorsal spine 1.2½; pectoral 1.1; ventral 2; longest anal ray 1.9; caudal lobe 1.3; depth of peduncle 3.3; its length 1.9. Barbel in eye 2.

Dorsal II, 7; anal 8. Scales 47.

¹*S. (C.) maculatus* (Günther) probably comes here. Depth 4; head 4; pectoral slightly less than head; scales 41; interorbital as wide as orbit.

Moderately compressed, the back little elevated; vent immediately before anal; head below and breast moderately flattened; the ventrals but not the pectorals in a horizontal plane. Snout pointed, its tip expanded with a dent behind well in advance of nostril; eye placed high, very slightly superolateral; mouth inferior, with rather



Fig. 22. *Hemibarbus labeo* (Pallas). 131 mm. without caudal.

thick lips, the lower jaw decidedly the shorter; a slender barbel near the end of the maxillary; interorbital very slightly concave; gill-membranes joined to isthmus under edge of preopercle. Last simple dorsal ray a long strong smooth spine, extending approximately to the tip of the fin; dorsal origin appreciably nearer tip of snout than base of caudal; ventral base under middle of dorsal; pectoral not quite reaching ventral; ventral not nearly reaching anal; caudal strongly forked with even pointed lobes. Lateral line complete, dipping slightly in front, running straight in center of tail.

Brownish; darker along the back; about 9 small blackish marks along side above lateral line; fins unmarked.

PSEUDOGOPIO Bleeker

BLEEKER, 1860, Prodr. Cypr., p. 215. Type: *Gobio esocinus* Temminck and Schlegel.

Short-bodied or moderately elongate, little compressed, more or less flattened on the breast; tip of snout usually marked off by a dent behind it; eye superolateral; mouth inferior; lips thick, free behind across chin, corrugated papillose; a barbel at the end of the maxillary; vent nearer ventral axil than to anal origin; breast naked. A main row of 5 teeth, sometimes 1 tooth in a second row. Scales in lateral line less than 45.

Pseudogobio kachekensis Oshima

Pseudogobio kachekensis OSHIMA, 1926, Annot. Zool. Japon., XI, p. 13. Kachek River, Hainan.

Length 62 mm. Depth in length, 6.4; head 4.25. Snout in head 2.4; eye 3. Dorsal rays 10; anal 8. Scales 34. Back indistinctly maculated with black; dorsal and caudal grayish; the rest of the fins whitish.

From the description this species is closer to *P. fukiensis* Nichols (1926, Amer. Mus. Novit., No. 224, p. 5, fig. 4) than to *P. labeoides* from Nodoa. It is slenderer than the former.

***Pseudogobio labeoides*, new species**

This fish bears a superficial resemblance to *Hemibarbus labeo*.

DESCRIPTION OF TYPE.—Number 8372, American Museum of Natural History. Locality: Nodoo, Hainan. Length to base of caudal 90 mm. Depth in length 4.8; head 3.4. Eye in head 3.7; snout 2; interorbital 5; maxillary 2.6; greatest width (at back of head) 1.9; depth of peduncle 3.5; its length 2; pectoral 1.3; ventral 1.8; longest dorsal ray 1.4; longest anal ray 2; caudal lobe 1.3; Barbel in eye 1.5.

Dorsal 9; anal 8. Scales 40. Teeth compressed, with a slight hook and pronounced shoulder.

Little compressed; head somewhat cuboid, broader beneath than above; vent more than twice as distant from anal origin as from ventral axil. Snout long and somewhat pointed, its end marked off by a dent before the nostril; upper jaw protractile downward; lower jaw much included; maxillary not reaching to opposite

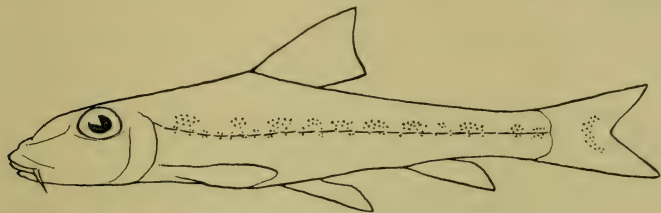


Fig. 23. *Pseudogobio labeoides*, type. 90 mm. without caudal.

front of eye; lips loose, corrugated-papillose, free behind across the chin; a small subterminal maxillary barbel; eye superolateral; interorbital a little concave; orbit with free rim and narrow membranous lids; gill-membranes joined to isthmus under hind border of eye. Dorsal and anal without spinous rays; dorsal origin equidistant from tip of snout and tip of last anal ray; ventral origin under middle of dorsal base; pectoral reaching ventral origin; ventral $\frac{2}{3}$ to anal; caudal moderately forked. Scales with close-spaced slightly radiating striæ; no scales on breast before pectoral axil; lateral line complete, straight in the center, rising a little in front to meet opercle.

Color pale, a series of small faint dark blotches along middle of side mostly above lateral line, with tendency to confluence; small blackish spots here and there along lateral line; back with a few spots and marks; short dark stripes forward from nostril meeting on snout; a small dark spot above pectoral axil; faint curved dark bar on caudal, fins otherwise plain.

Xenocypridinæ

Members of the genus *Xenocypris* are slender, free-swimming fishes, not unlike certain of the Abramidinæ in contours, but with a peculiar inferior transverse mouth. We are of the opinion that this mouth is a relic which they have from ancestral bottom-living fishes such as *Garra*, and include *Garra*-like and *Xenocypris*-like forms in a distinct subfamily.

GARRA Hamilton-Buchanan

HAMILTON-BUCHANAN, 1822, 'Fishes of the Ganges,' p. 393. Type: *Cyprinus lamila* Hamilton-Buchanan.

Little or moderately compressed; mouth inferior, transverse, curved; usually 1 or 2 pairs of barbels, sometimes absent; dorsal without a spine; gill-membranes broadly and conspicuously united to isthmus, a suctorial disc on the chin, free behind.

Garra imberbis (Vinciguerra)

Discognathus imberbis VINCIGUERRA, 1890, Ann. Mus. Genov., (2) IX, p. 277, Pl. IX, fig. 7. Karengé Hills, Burma.

Discognathus imberbis BOULENGER, 1899, Proc. Zool. Soc. London, pt. 2, p. 961.

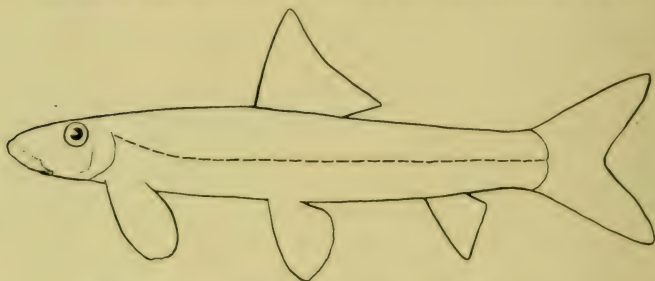


Fig. 24. *Garra imberbis* (Vinciguerra) after Vinciguerra.

Depth $5\frac{2}{3}$ to $6\frac{3}{4}$, head $4\frac{1}{2}$ to $5\frac{1}{2}$ in length of body. Width of head about $1\frac{1}{8}$ in its length. Eye small, $2\frac{1}{4}$ to $2\frac{1}{2}$ in length of snout, 2 to $2\frac{1}{2}$ in interorbital. No barbels. Dorsal 11; anal 7; lateral line 44. Teeth 5,4,1.

Boulenger lists this fish from Hainan. There is a possibility that he has confused it with *Varicorhinus discognathoides* Nichols and Pope, which it certainly is not.

Garra schismatorhyncha, new species

DESCRIPTION OF TYPE.—Number 8373, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 108 mm. Depth in length 4.5; head 4.1. Eye in head 4.6; snout 2; interorbital 2.7; maxillary 2; width of mental disk 2.1; depth of peduncle 1.9; its length 1.6; pectoral 1; ventral 1.2; longest dorsal ray 1; longest anal ray 1.4; caudal lobe 0.8. Barbels in eye 1.9.

Dorsal 10; anal 7. Scales 33.

Moderately compressed; top of head flat; lower surface of head breast and belly flat so that pectorals and ventrals are in a horizontal plane; vent something more than twice as far from ventral axial as from anal origin. Forehead ending in a triangular

projection, beneath which a deep re-entrance, and there is also a more anterior groove across lower level of snout; tip of forehead and top of snout with small horny warts; mouth transverse on lower surface of head about half-way between tip of snout and eye; overhung in front by membrane of lower surface of snout which has a finely papillose margin and regularly and rather finely notched edge; smooth chin and surrounding semicircular finely papillose lip forming a large disk, at the corner of which

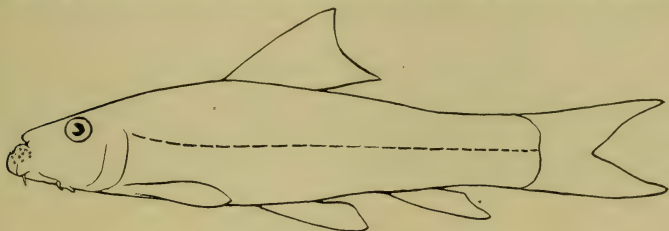


Fig. 25. *Garra schismatorhyncha*, type. 108 mm. without caudal.

there is a small maxillary barbel, about the same length as a small barbel at side of lower surface of snout; eye placed high, almost strictly lateral; gill-membranes conspicuously joined to isthmus on lower surface of head under posterior edge of eye; maxillary to under front of eye. Dorsal and anal without spines; dorsal origin equidistant from tip of snout and anal axil; ventral beneath the middle of dorsal; pectoral not reaching ventral, ventral not reaching anal; caudal forked, the lobes about equal. Scales rough, with fine parallel horizontal striae; lateral line complete, straight, in the center; large scales running well out on caudal base.

Color brownish; top and sides of head darker; as also an area on the end of the pectoral toward the inside, and distal outer margins of caudal.

Schismatorhynchos heterorhynchos of Sumatra and Borneo is deeper-bodied, with barbels shorter relative to the eye, and upper caudal lobe decidedly longer than the lower. Otherwise it resembles this species closely in appearance, but *G. schismatorhyncha* has a *Garra* mouth; unlike that figured for *S. heterorhynchos*.

G. schismatorhyncha was not a common fish in Hainan, for we got only two or three specimens. They were taken in the cascades of the river that flows three miles southwest of Nodoa.

VARICORHINUS Rüppell

RÜPPELL, 1836, Museum Senckenberg, II, p. 14. Type: *Varicorhinus beso* Rüppell = *Labeo varicorhinus* Cuvier and Valenciennes. BERG, 1916, 'Les Poissons des Eaux Douces de la Russie,' p. 244.

Free-swimming fishes with inferior mouth, less curved, more strictly transverse than in *Garra*; lower jaw coming to a sharp, cartilaginous edge; without free sucking disc at the chin; usually one or two pairs of

small or minute barbels; dorsal without a developed spine. Vent immediately before anal origin. Berg unites *Gymnostomus* and other genera under the comprehensive genus *Varicorhinus*. This may doubtless be apportioned into various subgenera to advantage, and our Hainan species appears to differ subgenerically from barbelled mainland forms. Many species and several generic names of long standing are involved.

***Varicorhinus discognathoides*, new species**

DESCRIPTION OF TYPE.—Number S389, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 225 mm. Depth in length 3.6; head 4.6. Eye in head 6; snout 2.3; interorbital 2.3; maxillary 2.1; width of mouth 2; width of body 1.4; depth of peduncle 1.5; its length 1.4; pectoral 1; ventral 1.1; longest dorsal ray 1; upper caudal lobe 0.6; distance between gill clefts 4.5.

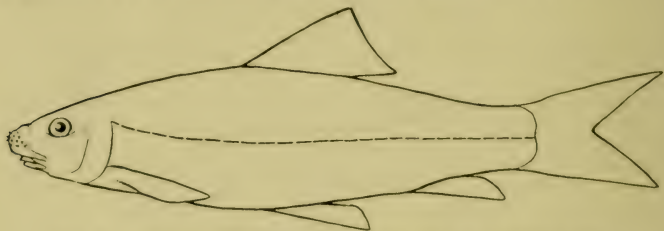


Fig. 26. *Varicorhinus discognathoides*, type. 225 mm. without caudal.

Dorsa' 12; anal 7. Scales 39. Teeth in 3 rows 5, 4, 2, not hooked, some of them truncate.

Compressed, front of back slightly elevated; vent almost immediately before anal origin. Head bluntly pointed, its top and lower surface flattish, the snout squarish. Tip of snout slightly gibbous, marked off by a transverse crease above; with a cross-band of small horny warts; mouth inferior, semicircular transverse; no barbels; maxillary slightly produced in a rounded point which reaches to under anterior margin of eye; free edges of vertical hanging snout membrane and upper lip slightly dented; lower jaw ending in a smooth curved leathery horizontal edge; lower lip papillose, broadly free in front and narrowly so behind; eye placed high, almost strictly lateral; with a free rim; gill-membranes broadly joined to side of breast under corner of preopercle. Dorsal origin equidistant from tip of snout and middle of peduncle; ventral under middle of dorsal base; pectoral reaching $\frac{2}{3}$ distance to ventral; ventral $\frac{1}{2}$ to anal; caudal moderately forked, the upper lobe the more pointed and slightly the longer. Scales rough with close set almost horizontal subparallel striae; lateral line complete, in the center, rising a little in front.

Dark, a little paler below; fins dusky.

ONYCHOSTOMA Günther

GÜNTHER, 1896, Ann. Mus. Zool. St. P., pt. 1, p. 211, Pl. 1, fig. b. Type: *Onychostoma laticeps* Günther.

This genus differs from *Varicorhinus* in having a serrate dorsal spine.

***Onychostoma leptura* (Boulenger)**

Gymnostomus lepturus BOULENGER, 1899, Proc. Zool. Soc. London, pt. 2, p. 961.

Description based on a specimen 125 mm. long to base of caudal from Nodoa:

Depth in length 4; head 4.5 (to 5). Eye in head 3.3; snout 2.5 (to 3.5); inter-orbital 2.4; maxillary 2.5; width of mouth 2.4; depth of peduncle 2.5; its length 1.2; pectoral 1.2; ventral 1.2; longest dorsal ray 1.3; longest anal ray 1.4; caudal lobe 0.6.

Dorsal 10; anal 7 (or 8). Scales 46 (to 49). Teeth 3-rowed, 4, 4, 2, loosely attached, with bluntly pointed tips.



Fig. 27. *Onychostoma leptura* (Boulenger). 135 mm. without caudal.

Moderately compressed; head short and blunt; lower surface of snout and lower jaw flat; upper jaw protractile; maxillary horizontal, to under front margin of eye; no barbels. Mouth inferior, straight across, without free lips; edge of lower jaw thin, leathery, red-brown; edge of snout with three conspicuous horny warts in center, a smaller one at each side; gill-membranes united to breast under edge of preopercle. Last simple dorsal ray stiffened (spinous) for most of its length, concave behind with sheathed barbs at the edges, and with a soft tip; center of dorsal base equidistant from front of eye and base of caudal, situate over anterior rays of ventral; pectoral not reaching ventral, ventral not reaching anal; caudal deeply forked, the lobes equal. Scales rough-pimply, with inconspicuous radiate striae; lateral line complete; dipping slightly anteriorly, otherwise straight and in the center of side.

Dark above; paler below; scales of back and sides conspicuously outlined with dark.

This *Onychostoma* agrees in general so well with Boulenger's figure of *Gymnostomus lepturus* that we have little hesitation in referring it to that species. Boulenger does not describe or figure the serrate dorsal spine, which is less strong than in *O. laticeps*.

LABEO Cuvier

CUVIER, 1817, 'Regne Animal,' II, p. 194. Type: *Cyprinus niloticus* (Forsk.) Geoffroy.

The species described here is related to *Labeo garnieri* Sauvage, 1884, Tonkin and *Labeo jordani* Oshima, 1919, Formosa. With them it might perhaps as well be placed in the heterogeneous genus *Varicorhinus* or stand apart as a distinct genus.

Labeo collaris, new species

DESCRIPTION OF TYPE.—Number S399, American Museum of Natural History, Locality: Nodoo, Hainan. Length to base of caudal 202 mm. Depth in length 2.9; head 4.7. Eye in head 3.6; snout 2.7; interorbital 1.9; maxillary 3.5; width of mouth 2.6; greatest width of body 1.5; depth of peduncle 1.5; its length 1.4; pectoral 1.1; ventral 1; longest dorsal ray 0.7; longest anal ray 1.3; upper caudal lobe 0.5.

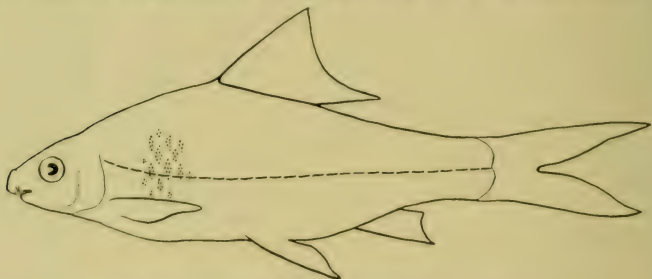


Fig. 28. *Labeo collaris*, type. 202 mm. without caudal.

Dorsal 14; anal $7\frac{1}{2}$. Scales 39. Pharyngeal bone peculiar, pierced by foramina; teeth 10 in all, crowded into a double row, loosely attached, some of them compressed, broad, truncate.

Compressed; the head short broad and blunt; breast and belly rounded; vent immediately before anal origin. Mouth inferior, transverse, slightly curved, about halfway between end of snout and front of eye; upper lip slightly fluted, overhung by snout membrane; lower lip narrow, slightly papillose, free behind, separated by a slight crease in front from the narrow, curved, only slightly leathery, uncolored edge of the jaw; a pair of small barbels on the snout before the mouth, none at the corner of the mouth; maxillary not nearly reaching to under front of eye; interorbital slightly convex; eye strictly lateral; gill-membranes broadly joined to isthmus under edge of preopercle; a number of small horny warts on the tip of snout. Dorsal without spinous rays; its origin equidistant from the end of snout and anal axil; ventrals placed under middle of dorsal; pectoral reaching $\frac{5}{8}$ the distance to ventral; ventral $\frac{3}{4}$ to anal; caudal deeply forked with pointed lobes, the upper the longer. Scales with close-spaced subparallel slightly radiating striae; lateral line complete straight in the center, rising very slightly in front; a triangular plate above the base of the pectoral and long pointed ventral axillary flat.

Small blackish bars at the bases of many of the scales, these larger and more distinct in a vertical band over the middle of pectoral. A whitish patch under the eye.

Named from the peculiar cross-mark above the pectoral which appears to be characteristic.

XENOCYPRIS Günther

GÜNTHER, 1868, 'Cat.,' VII, p. 205. Type: *Xenocypris argentea* Günther.

Like *Varicorhinus*; dorsal with an initial strong smooth spine; no barbels; vent immediately before anal origin. Teeth 3-rowed, 6 or 7, 3 or 4, 2.

Xenocypris insularis, new species

DESCRIPTION OF TYPE.—Number 8374, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 213 mm. Depth in length 3.7; head 4.9. Eye in head 4; snout 3.2; interorbital 2.8; maxillary 4.5; width of mouth 4.6; greatest width of body 1.8; depth of peduncle 1.9; its length 1.8; pectoral 1.3; ventral 1.4; longest dorsal ray 0.9; longest anal ray 1.9; upper caudal lobe 0.7.

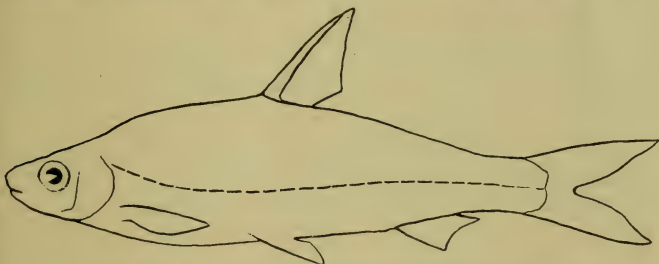


Fig. 29. *Xenocypris insularis*, type. 213 mm. without caudal.

Dorsal II, 7; anal 13. Scales 63.

Compressed; a division between the scales in the center on the posterior part of the belly as though for a low rudimentary keel. Mouth small, inferior, slightly curved, transverse; maxillary not nearly to front of eye; no barbels; interorbital convex; gill-membranes joined to isthmus under edge of preopercle. Dorsal origin equidistant from tip of snout and base of caudal or slightly nearer the former, dorsal with a long strong spine almost reaching tip of fin; ventral origin under that of dorsal; pectoral reaching $\frac{3}{5}$ the distance to ventral; ventral about $\frac{1}{2}$ to anal; caudal strongly forked with pointed lobes, the upper a little the longer. Scales with rather close set conspicuous moderately radiating striae; lateral line complete, a little bent down, in the center of peduncle; a large triangular bluntly pointed scapular plate over base of pectoral.

Darkish above; lower sides, cheeks and most of opercle pale; fins plain.

This is very likely what Oshima (1926) has identified with the widely distributed *X. davidi* Bleeker, to which it is close.

Rasborinæ

When the various series of whiskered Cyprininae, bottom-living Gobioninae, cross-mouthed Xenocypridinae, keeled Abramidinae, and others have been taken from the Cyprinidae, there remains a vast number of minnow- and club-like species occurring anywhere in the range of the family; usually slender; belly keelless or rarely with a trace of a keel; dorsal short, without developed spine; barbels absent or rarely present, then small or minute; vent immediately before anal origin. Lacking a more complete knowledge of their relationships, we are inclined to place all these in the Rasborinae, though that subfamily might better be and doubtless usually has been by authors restricted to species with more clearly traceable relationship to the genus *Rasbora*.

RASBORA Bleeker

BLEEKER, 1859, 'Conspectus Syst. Cypr.,' Nat. Tijdschr. Ned.-Ind., XX, p. 435. Type: *Cyprinus rasbora* Hamilton-Buchanan.

Mouth normal, moderately oblique, lower jaw projecting; no barbels and no keel on belly; lateral line complete, running low, below the center for most or all its course on peduncle. Small fishes of southern Asia. Teeth 4, 3, 2.

Rasbora cephalotænia (Bleeker)

Leuciscus cephalotænia BLEEKER, 1852, Nat. Tijdschr. Ned.-Ind., III, p. 97. *Rasbora cephalotænia* Weber and de Beaufort, 1916, III, p. 74, fig. 25.

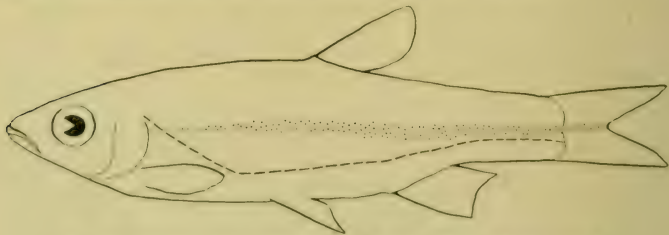


Fig. 30. *Rasbora cephalotænia steineri*, type. 65 mm. without caudal.

Rasbora cephalotænia steineri, new subspecies

Seven rows of scales between the lateral lines counted over the back of the middle of the caudal peduncle. Origin of dorsal behind the center point between snout and hindermost caudal scales; over the ventral

axil. Base of dorsal in middle between ventrals and anal or slightly nearer the former. A black band on the sides. Pectoral $\frac{3}{8}$ length of head. Scales 30; origin of dorsal opposite 12th scale; $4\frac{1}{2}$ scales between lateral line and dorsal, one between lateral line and ventrals.

DESCRIPTION OF TYPE.—Number 8375, American Museum of Natural History. Locality: Nodoa, Hainan, July 15, 1923. Length to base of caudal 65 mm. Depth in length 3.6; head 3.7. Eye in head 3.5; snout 3; interorbital 2.9; maxillary 3; depth of peduncle 2; length of peduncle 1; pectoral 1.5; ventral 1.6; height of dorsal 1.4; longest anal ray 1.8; caudal lobe 1.4.

Dorsal 9; anal 7. Scales 30.

Mouth moderately oblique; lower jaw projecting; end of lower jaw broad, its center and corners prominent, fitting slight emarginations in the upper; maxillary mostly concealed by preorbital. Gill-membranes free or very narrowly attached to one another or isthmus. No barbels. Last simple ray of dorsal not enlarged or spinous; ventral origin before dorsal; pectoral not reaching ventral; ventral not reaching anal; caudal forked, the lobes bluntly pointed. Scales thin and rather deciduous, striæ numerous and somewhat radiating; lateral line complete, slanting down over pectoral and running low; slanting up on peduncle, terminating at about its center.

A black stripe from opercle to caudal, continued narrowly across same; scales of sides margined with dark; belly whitish; fins grayish. A color sketch from life is olive greenish, on the sides and below silvery; fins tinged with olive, ventrals pale; a sharp black stripe from the head to the notch of the caudal fin.

Probably distinguishable as a race from East Indian *Rasbora cephalotenia*, having slightly fewer scales, greater depth and other slight differences.

Named for Rev. J. F. Steiner, of the American Presbyterian Mission of Hainan, in appreciation of his interest in the work.

BARILIUS Hamilton-Buchanan

HAMILTON-BUCHANAN, 1822, 'Fishes in the Ganges,' p. 384. Type: *Cyprinus barila* Hamilton-Buchanan.

Slender, peduncle long, caudal deeply forked. Mouth terminal but the lower jaw tends to be the shorter and the snout to project. No dorsal spine. Anal rather long. Scales rather small. Fishes of southern Asia and of Africa.

Barilius hainanensis Boulenger

Barilius hainanensis BOULENGER, 1899, Proc. Zool. Soc. London, pt. 2, p. 961, Pl. LXIX, fig. 2.

This species is not found in our collection. We quote Boulenger's description:

Depth of body equal to length of head, $4\frac{2}{3}$ times in total length. Head twice as long as broad; snout pointed, not projecting beyond the mouth, as long as diameter

of eye, which is $3\frac{1}{2}$ times in length of head and equals interorbital width; mouth extending hardly to below anterior border of eye; suborbitals entirely covering the cheek. Dorsal II, 7, originating just behind ventral and situated at equal distance

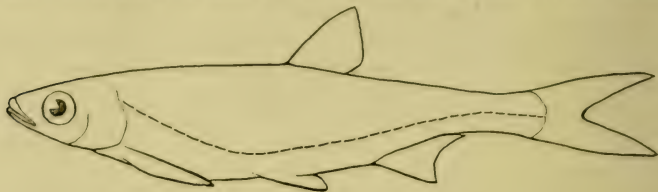


Fig. 31. *Barilius hainanensis* Boulenger after Boulenger.

from the eye and the root of the caudal; first branched ray $\frac{2}{3}$ length of head. Pectoral a little shorter than head, not reaching ventral. Anal II, 14. Caudal deeply bifurcate, as long as head. Caudal peduncle nearly thrice as long as deep. Sq. $46\frac{2}{3}$. Silvery, darker on the back; scales above the lateral line black at the base. Total length 130 mm. A single specimen.

Zacco Jordan and Evermann

JORDAN AND EVERMANN, 1902, Proc. U. S. Nat. Mus., XXV, p. 322. Type: *Leuciscus platypus* Temminck and Schlegel.

Large-mouthed species related to *Rasbora* and *Opsariichthys*. Scales rather small, lateral line running low. Jaws equal or the lower projecting. The anal is rather long and in the adult its rays are widened with exerted tips. Belly more or less keeled behind ventrals. Eastern China and Japan.

Zacco asperus, new species

Opsariichthys platypus, BOULENGER, 1899, Proc. Zool. Soc. London, pt. 2, p. 961, not *platypus* of Temminck and Schlegel.

DESCRIPTION OF TYPE.—Number 8376, American Museum of Natural History. Locality: Nodou, Hainan. Length to base of caudal 106 mm. Depth in length 3.5; head 3.5. Eye in head 4; snout 3; interorbital 3; maxillary 2.1; depth of peduncle 2.3; its length 1.8; longest dorsal ray 1.4; pectoral 1.3; ventral 1.6; longest anal ray 1; caudal lobe 1.

Dorsal 9; anal $14\frac{1}{2}$. Scales 47; $8\frac{1}{2}$ rows between lateral line and dorsal origin, 2 between lateral line and ventral.

Compressed; head pointed, its top flat; nape somewhat elevated; belly between ventrals and vent a narrow compressed ridge, across which the scales pass anteriorly but apparently not posteriorly. Mouth oblique, lower jaw projecting, with a point at the tip fitting into a notch in the tip of the upper jaw; cleft of mouth a little curved in front to suggest *Opsariichthys* slightly; maxillary narrow, not quite to under center of eye; no barbels; gill-membranes very narrowly joined to isthmus behind hind edge

of eye; a close row of horny tubercles across lower preopercle; a similar row on side of mandible; a double or triple row of smaller ones across face below eye. Tubercles on head more pronounced and regular than in related species. Dorsal and anal without spinous rays; dorsal origin equidistant from front of eye and base of caudal, immediately behind axil of ventral; pectoral barely reaching ventral, ventral not to anal; anal with its central rays simple, elongate exerted; caudal forked with pointed lobes the lower a little the longer. Scales with subparallel or slightly radiating striae; lateral line complete, much decurved, running low, rising on peduncle to gain its center several scales before the end.

Dark along the back, pale below. Scattered irregular narrow dark vertical marks on side; a vague dark central stripe at base of peduncle. Caudal and base of dorsal dark grayish.

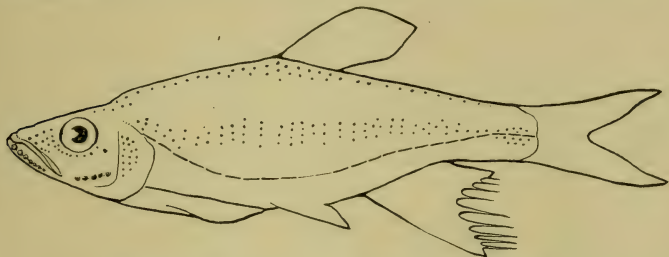


Fig. 32. *Zacco asperus*, type. 106 mm. without caudal.

Seventeen specimens (cotypes), length 85 to 110 mm., measure as follows: depth 3.9 to 3.2; head 3.3 to 3.6; eye 3.6 to 4.4; interorbital 3.5 to 2.9. Dorsal rays 9 to 10; anal 13 to 15; scales 47 to 51.

OPSARIICHTHYS Bleeker

BLEEKER, 1863, *Neder. Tijdschr. Dierk.*, I, p. 203. Type: *Leuciscus uncistrostris* Temminck and Schlegel.

Large-mouthed species closely related to *Zacco*. A conspicuous projection on upper jaw at side of snout, fitting into a notch in lower jaw. Scales rather small, lateral line running low, etc. A few closely related species in eastern Asia.

Opsariichthys hainanensis, new species

DESCRIPTION OF TYPE.—Number 8377, American Museum of Natural History. Locality: Nodoa, Hainan. Length to base of caudal 115 mm. Depth in length 3.8; head 3.4. Eye in head 5.3; snout 2.8; interorbital 3.2; maxillary 2; depth of peduncle 3; its length 1.8; pectoral 1.5; ventral 2; longest dorsal ray 1.5; longest anal ray 1.4; lower caudal lobe 1.1.

Dorsal 9; anal 12. Scales 40; $7\frac{1}{2}$ rows between lateral line and dorsal origin, $2\frac{1}{2}$ between lateral line and ventral.

Body compressed; snout pointed; profile low; top of head flat. Mouth large, oblique; a projection on upper jaw at side of snout fitting into a re-entrance in lower jaw; lower jaw slightly projecting, its narrow tip received in a notch at tip of snout; maxillary to under posterior border of eye. Dorsal and anal without spinous rays; dorsal origin equidistant from tip of snout and base of caudal; ventral origin under that of dorsal; pectoral not quite reaching to that of ventral, ventral not to anal; anal falcate; caudal well forked, lower lobe the longer. Scales with radiating striae; lateral line complete, curving downward and running low, slanting up across peduncle to end in its center.

No color markings.

Deeper and with fewer scales than *Opsariichthys bidens*.

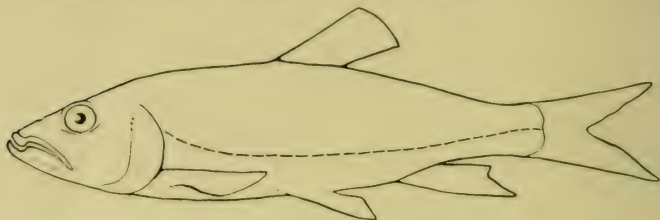


Fig. 33. *Opsariichthys hainanensis*, type. 115 mm. without caudal.

Among other *Nodoa* material we find a specimen (cotype) closely resembling this one, which has length 123 mm.: depth 3.5; head 3.2; eye 4.8; dorsal rays $9\frac{1}{2}$; anal $11\frac{1}{2}$; scales 43. There are also three specimens 97 to 105, and 128 mm. long which are probably males of the same. They have fine warts, thickly placed on the lower jaw, scattered below the eye, and a row along the lower limb of the preopercle; higher anal fin; faint dark marks on the sides, especially posteriorly, membrane between dorsal rays dusky; depth 4 to 4.1, 4.3; head 3.2 to 3.1; eye 5 to 5.5; longest anal ray 1.2, 1.4; dorsal rays $9\frac{1}{2}$; anal 11, $11\frac{1}{2}$; scales 42 to 43, 44. The largest of these three however looks quite different, and it may be that two or even three closely related forms are involved. It has a stouter head, less compressed more slender body, and hook in the jaws most pronounced; its lower jaw is slightly projecting as in the type and cotype, whereas in the two other specimens with warts, the jaws are even.

Abramidinæ

The primary, conspicuous character in this sub-family is a keel on the belly between the ventral and anal fins. Barbels are lacking; vent immediately before anal origin. A well-developed dorsal spine may be present or absent and when present is almost invariably smooth. The

anal is usually rather long. They are free-swimming fishes, frequently deep-bodied, sometimes slender. Good generic characters are to be found in extension of the keel onto the breast before the ventrals, presence or absence of dorsal spine, projecting or included lower jaw, course of the lateral line. We include here all species with keeled belly, except for one or two with obvious affinities elsewhere, and call to mind no species without a keel entitled to be considered an Abramidin. This treatment will include in the Abramidinæ one or two aberrant genera like *Hypophthalmichthys*, the true position of which is uncertain.

MEGALOBAMA Dybowski

DYBOWSKI, 1872, Verh. Zool. Bot. Gesell. Wien, XXII, p. 212. Type: *Megalobrama skolkovii* = *Chanodichthys terminalis*.

Deep- or moderately deep-bodied; dorsal with an initial spine; jaws approximately equal; lateral line slightly and evenly decurved; keel confined to the belly behind ventrals. A few species of eastern Asia not very closely related one to the other, nor very different from *Erythroculter* and *Hemiculter*.

Megalobrama melrosei, new species

DESCRIPTION OF TYPE.—Number 8378, American Museum of Natural History. Locality: Nodoa, Hainan. Length to base of caudal 66 mm. Depth in length 3.1; head 3.8. Eye in head 2.7; snout 3.8; interorbital 3.8; maxillary 3.4; depth of

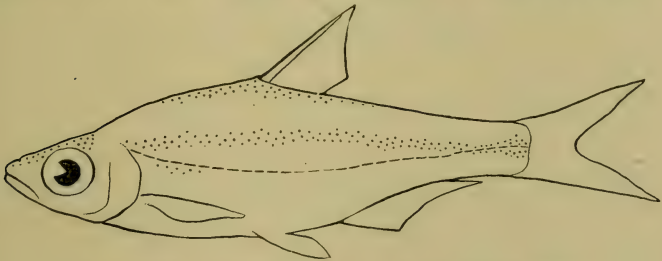


Fig. 34. *Megalobrama melrosei*, type. 66 mm. without caudal.

peduncle 2.5; its length 1.9; pectoral 1.3; ventral 1.5; longest dorsal ray 1; longest anal ray 2.2; lower caudal lobe 0.8.

Dorsal II, 7; anal 23. Scales 54. Teeth 3-rowed 5, 4, 2, slightly hooked.

Compressed; breast broad and rounded; a low keel between ventrals and anal, which keel is scaled to its margin; top of head flattish; back somewhat elevated. Interorbital very slightly convex; jaws equal, the upper protractile; maxillary concealed, to under front margin of eye; no barbels; eye with a free rim; gill-membranes

broadly joined to one another and to isthmus under back of eye. Dorsal with a strong slender spine, which however has a filamentous tip; dorsal origin equidistant from tip of snout and base of caudal; over ventral axil; pectoral almost or quite reaching ventral origin; ventral not quite to anal; caudal well forked with narrow pointed lobes, the lower slightly the longer. Scales with a few faint radiating striae; lateral line complete, gently bent down, in the center of most of the peduncle.

Pale; top of head and crest of back dark; a plumbeous stripe from shoulder to base of caudal above lateral line; 2 or 3 lines of small spots following rows of scales paralleling anterior part of lateral line.

This species is very close to *Megalobrama macrops* (Günther) from Formosa, which apparently also is found in Fukien. Obvious slight differences which it shows are jaws equal versus lower slightly included; a ray or two less in the anal; a few less scales in the lateral line.

Named for Mrs. J. C. Melrose, of the American Presbyterian Mission of Hainan, in appreciation of her interest in the work.

This is very likely what Oshima (1926) identifies with *Chanodichthys affinis* Vaillant from Indo-China.

PARABRAMIS Bleeker

BLEEKER, 1865, Ned. Tijdschr. Dierk., II, p. 21. Type: *Abramis pkinensis* Basilewski.

A smooth bony spine in the dorsal. Keel present before as well as behind the ventrals. Lateral line comparatively little bent down. Jaws approximately equal. Anal long. Teeth in 3 rows.

Parabramis pkinensis (Basilewski)

Abramis pkinensis BASILEWSKI, 1855, N. Mem. Soc. Nat. Mosc., X, p. 238, Pl. VI, fig. 2. North China.

Chanodichthys stenzi POPTA, Oshima, 1926, Annot. Zool. Japon., XI, p. 18. Kachek River, Hainan

Chanodichthys stenzi is a synonym of *Parabramis pkinensis*. There is some doubt if Oshima (1926) has correctly identified his fish so recorded, and for which the following measurements are given.

Length 170 mm. Depth 3.55; head 4.10. Eye in head 3.34; snout 3.34; interorbital 2.85. Dorsal II, 7; anal 30. Scales 53.

CULTER Basilewski

BASILEWSKI, 1865, N. Mem. Soc. Nat. Mosc., X, p. 236. Type *Culter alburnus* Basilewski.

A smooth bony spine in the dorsal. Keel extending the whole length of the lower profile, from between the axils of the pectorals to the anal. Lateral line little bent down. Lower jaw projecting, the mouth sub-vertical. Teeth in 3 rows.

Culter brevicauda Günther

Culter brevicauda GÜNTHER, 1868, Cat. VII, p. 329. Formosa.

Recorded by Oshima (1926) from the Kachek River, Hainan. One of his Hainan specimens measured as follows.

Length 211 mm. Depth in length 3.95; head 4.57. Eye in head 4.22; snout 4.22; interorbital 4.75; pectoral 1; ventral 1.26. Dorsal II, 7; anal 30. Scales 65.

ERYTHROCULTER Berg

BERG, 1909, Mem. Ac. Sc. St. Petersburg, (8) XXIV, p. 138. Type: *Culter erythropterus* Basilewski.

Slender or moderately deep; the mouth oblique and lower jaw projecting; dorsal with a well-developed spine in front; belly with a keel behind ventrals only; lateral line little decurved; anal rather long, scales rather small.

Berg identifies *Culter alburnus*, the type of *Culter*, with a species wherein the keel extends forward of the ventrals, and proposes *Erythroculter* as a subgenus for those wherein it is confined to the region behind these fins. *Culter brevicauda*, one of the former category which we have examined, is generically distinct from those of the later category. Whereas we suspect that Basilewski's *alburnus* was actually a species with posterior keel only, quite likely identical with his *erythropterus*, one opinion is as good as another as to this and we follow Berg's ruling. Incidentally, the Hainan fish approaches *Culter brevicauda* more closely than any other *Erythroculter* known to us.

Erythroculter pseudobrevicauda, new species

DESCRIPTION OF TYPE.—Number 8400, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 170 mm. Depth in length 3.9; head 4. Eye in head 3.3; snout 3.8; interorbital 5; maxillary 3; greatest width (the back of head) 2.5; depth of peduncle 2.5; its length 1.5; dorsal spine 1.2; longest dorsal ray 1.2; longest anal ray 2; pectoral 1.4; ventral 1.5; lower caudal lobe 1.

Dorsal II, 7; anal 26. Scales 75; before dorsal 56.

Slender, compressed, breast rounded; belly behind ventrals sharply keeled; vent immediately before anal origin. Top of head flattish rising to tip of maxillary; nape elevated; interorbital narrow, a little convex; lower jaw strongly projecting; mouth strongly oblique; maxillary not quite to front of eye; no barbels; gill-membranes narrowly joined under center of eye, free from isthmus; opercle with a well-developed membranous edge. Dorsal with a strong sharp spine; its origin equidistant from end of snout and base of caudal, behind ventral axil; pectoral not quite reaching ventral, ventral $\frac{3}{4}$ to anal; caudal deeply forked, its lower lobe decidedly the longer. Scales with conspicuous radiating striæ, those on front of back very small; lateral line complete, almost straight in the center, rising slightly in front.

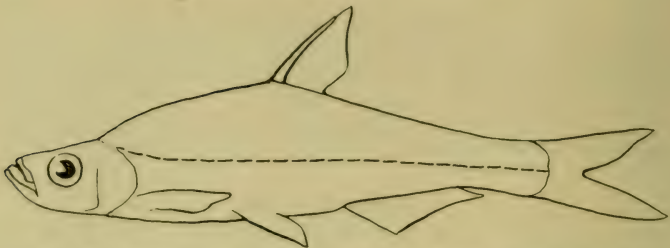


Fig. 35. *Erythroculter pseudobrevicauda*, type. 170 mm. without caudal.

Pale, darker on top of mandible, top of snout and along back; caudal with narrow dusky tips and edge within the fork.

Close to *Erythroculter aokii* (Oshima) from Formosa, differing in straighter lateral line with fewer scales, etc.

HEMICULTER Bleeker

BLEEKER, 1859, 'Conspectus Syst. Cypr.,' Nat. Tijdschr. Ned.-Ind., XX, p. 432. Type: *Culter leucisculus* Basilewski.

Slender; an initial dorsal spine; jaws about equal; lateral line running low with three abrupt turns, slanting down over pectoral, thence horizontal to about anal axil, thence slanting up to center of peduncle; teeth 3-rowed, 5, 4, 1 or 2. The abdominal keel may extend forward on breast (subgenus *Hemiculter*)¹ or stop at the ventrals (subgenus *Pseudohemiculter* new; type *Hemiculter hainanensis*).

Hemiculter hainanensis, new species

DESCRIPTION OF TYPE.—Number 8379, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 115 mm. Depth in length 3.7; head 3.5. Eye in head 3.8; snout 3.4; interorbital 3.8; maxillary 3; depth of peduncle 2.8; its length 2; pectoral 1.2; ventral 1.7; longest dorsal ray 1.4; longest anal ray 2.4; lower caudal lobe 1.

Dorsal II, 7; anal 17. Scales 56. Teeth 3-rowed, 5, 4, 2, mostly slightly hooked.

Compressed; profile almost horizontal; breast broad and rounded; belly behind ventrals with a low keel which scales do not cross; vent opening in a wide back-

¹We follow Berg (1916, 'Poiss. Eaux. Douc. Russ.,' p. 324) in identifying *Culter leucisculus* Basilewski, the type of *Hemiculter* Bleeker, with a species wherein the abdominal keel extends forward of the ventrals. Those species wherein the keel is present only behind the ventrals are at least subgenerically distinct, but the Formosan fish to which Oshima (1919, Ann. Carn. Mus., XII, p. 253) assigns the name *Cultrisculus*, is apparently close to *H. leucisculus* as understood by us. However, he makes *Hemiculter kneri* Kreyenberg the type of *Cultrisculus*, and the Yang-tze fish which we identify therewith, and which is certainly not his Formosan one, may stand as a third subgenus,—less compressed, first bend in lateral line little pronounced, scales deciduous. *Hemiculter kneri* Kreyenberg and Pappenheim, 1908 is antedated by *Hemiculter kneri* Warpachowski, 1888. A more detailed study of the names involved is recommended to those who enjoy the complexities of nomenclature.

wardly directed tube. Jaws equal; mouth oblique; tip of maxillary concealed, barely reaching to under front of eye; no barbels; upper jaw protractile; corner of the preopercle projecting slightly backward; opercle with faint downwardly radiating striæ; and a well-developed membranous edge; sides of snout with a few small poorly developed warty points; interorbital flattish; orbit with a free rim and narrow membranous lid all round; gill-membranes joined to one another and center of

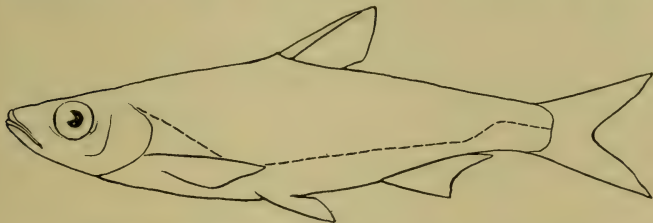


Fig. 36. *Hemiculter hainanensis*, type. 115 mm. without caudal.

isthmus under posterior border of eye. Dorsal with a sharp slender spine reaching almost to its tip; dorsal origin equidistant from base of caudal and middle of snout; slightly behind ventral axil; pectoral passing ventral origin; ventral reaching $\frac{2}{3}$ distance to anal; caudal forked with narrow pointed lobes, the lower the longer. Scales with radiating striæ; lateral line complete, slanting down abruptly over pectoral, running low to anal axil, thence rising abruptly to center of peduncle.

Pale, a little darker along the back.

This species is apparently close to *Hemiculter dispar* Peters from Hongkong, but deeper and with smaller scales. The two should be compared and may prove identical.

***Hemiculter serracanthus*, new species**

A long pointed, big-eyed *Hemiculter*, with keel confined to the belly, very strong dorsal spine, finely serrate behind.

DESCRIPTION OF TYPE.—Number 8380, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 113 mm. Depth in length 4.5; head 3.8. Eye in head 3.1; snout 3.3; interorbital 3.6; maxillary 3; width of body 2.8; depth of peduncle 2.9; its length 1.9; pectoral 1.2; ventral 1.8; dorsal spine 1.1; longest anal ray 2; caudal lobe 1.

Dorsal II, 7; anal 16. Scales 53. Teeth 3-rowed, 5, 4, 2, with hooked tips.

Elongate, compressed; breast rather broadly rounded; belly with a naked keel. Head narrowly pointed; orbital rim raised and center of interorbital slightly convex so that space between the eyes, as a whole, is flattish; lower jaw very slightly included; maxillary concealed, barely reaching front of eye; tip of mandible fitting into a notch in tip of upper jaw; its edges somewhat expanded to close the mouth tightly when center slips within upper jaw; sides of lower jaw with small crowded poorly developed warty points; gill-membranes narrowly joined to center of isthmus behind the back

of the eye; opercle with well-developed membranous edge. Dorsal with a long strong spine which reaches approximately to tip of fin, very finely serrate on its hind edges; dorsal origin equidistant from base of caudal and middle of snout; immediately behind ventral axil; pectoral long, narrow, pointed, reaching ventral; ventral $\frac{2}{3}$



Fig. 37. *Hemiculter serratocanthus*, type. 113 mm. without caudal.

to anal; caudal well forked with narrow pointed lobes, the lower slightly the longer. Scales with well-marked somewhat radiating striae; lateral line complete, slanting down abruptly to over end of pectoral, running low, and rising by an abrupt slant to the center on front of peduncle.

Dark above, whitish below.

ISCHIKAUIA Jordan and Snyder

JORDAN AND SNYDER, 1900, Proc. U. S. Nat. Mus., XXIII, p. 346. Type: *Opsariichthys steenackeri* Sauvage.

Body of moderate depth; dorsal without a spine; lower jaw projecting; keel not extending forward of ventrals; scales small; lateral line running low as in *Hemiculter* but less abruptly bent. Two or three species near the Pacific coast of Asia, to which the relationship of others in the interior is of doubtful closeness.

Ischikauia hainanensis, new species

DESCRIPTION OF TYPE.—Number S390, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 71 mm. Depth in length 3.6; head 3.6. Eye in head 3; snout 3.4; interorbital 3.5; maxillary 2.5; greatest width of body 2.5; depth of peduncle 2.5; its length 1.4; pectoral 1.5; ventral 1.5; longest dorsal ray 1.4; longest anal ray 1.8; caudal lobe (tip broken) about 1.1.

Dorsal 9; anal 18. Scales 50. Teeth slender, slightly hooked, 3-rowed, 5, 3 or 4, 1 or 2.

Compressed; nape somewhat elevated; top of head straight, the ends of jaws rising above its level; breast broadly rounded, belly keeled. Mouth subvertical; lower jaw projecting; maxillary to under front margin of eye; interorbital gently convex; gill-membranes narrowly joined to isthmus under hind edge of pupil; opercle with a conspicuous membranous edge. Dorsal without spinous rays, its origin equi-

distant from base of caudal and middle of eye, nearer anal origin than ventral axil; anal origin under posterior part of dorsal; pectoral reaching ventral, ventral not quite to anal; caudal well forked. Scales with radiating striae; lateral line complete, slanting down steeply to over ventral, thence running low to over anal axil, thence rising to run in the center of the posterior part of peduncle, its changes of direction not very abrupt.

Pale; a plumbeous stripe in center of peduncle from under front of dorsal.

Description of a small specimen (43 mm. to b.c.), *Nodoa*, Hainan, February 23, 1923. Depth in length 3.6; head 3.6. Eye in head 2.7; snout 3.5; interorbital 3.5; maxillary 2.7; depth of peduncle 2.7; length of peduncle 1.4; pectoral 1.2; ventral 1.4; dorsal lobe height 1; anal lobe height 1.4; caudal lobe 0.8.

Dorsal 9; anal 9. Scales not sufficiently developed to count; about 30 rows between nape and dorsal.



Fig. 38. *Ischikauia hainanensis*, type. 71 mm. without caudal.

Slender, compressed; the slender peduncle with a slight keel behind confluent with rudimentary precurent rays of caudal, above and below; breast rounded; an elevated keel between ventrals and anal; profile low, slightly concave. Mandible projecting; mouth moderately oblique; maxillary mostly concealed, to or not quite to front of eye; no barbels; gill-membranes free from one another or joined at very base, free from isthmus. Simple rays in front of dorsal and anal not thickened or spinous; dorsal and anal falcate; caudal deeply forked; pectoral reaching slightly past ventral origin; ventral just to anal; dorsal origin equidistant from base of caudal and front of eye, its first ray behind ventral base, last over anal origin. Lateral line complete, slanting down steeply over pectoral, running low to near axil of anal, then slanting up to center of peduncle, and ending slightly below its center.

Pale, a little darker along back, and a dark area on nape; narrow blackish stripe from near gill-opening to base of caudal. Pale in life, body and fins translucent.

APHYOCYPRIS Günther

GÜNTHER, 1868, 'Cat. [Fishes,' VII, p. 201. Type: *Aphyocypris chinensis* Günther.

Hemigrammocypripis FOWLER, 1910, Proc. Acad. Nat. Sci. Phila., LXII, p. 483.

Small species with no dorsal spine and keel on the belly only; mouth oblique. Resemble *Rasborinus*, but anal short. Lateral line sometimes incomplete. Teeth 5, 3, 1; or 4, 3.

Aphyocypris normalis, new species

Plate XXVI, Figure 4

DESCRIPTION OF TYPE.—Number 8381, American Museum of Natural History. Locality: Nodda, Hainan, March 2, 1923. Length to base of caudal 64 mm. Depth in length 4; head 4. Eye in head 4; snout 4; interorbital 2.5; maxillary 2.8; depth of peduncle 2; length of peduncle 1.4; pectoral 1.2; ventral 1.7; longest dorsal ray 1.5; longest anal ray 1.7; caudal lobe 1.

Dorsal 10; anal $10\frac{1}{2}$. Scales 35. Teeth 2-rowed, pointed, the tips slightly bent, 4, 3. (The teeth vary 4, 3; 4, 4, or 5, 3; 5, 4.)

Head rather broad and blunt, body compressed, interorbital flat; mouth moderately oblique; maxillary to under front of eye; jaws equal; no barbels; band of

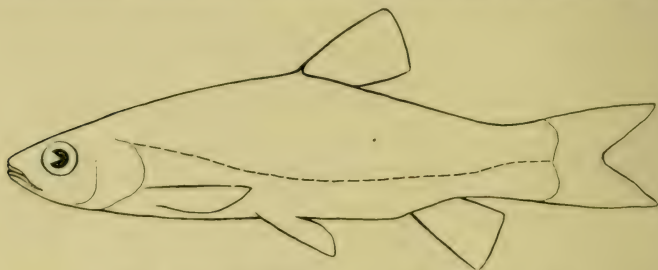


Fig. 39. *Aphyocypris normalis*, type. 64 mm. without caudal.

small warts on lower jaw; conspicuous pores on lower edge of preopercle. Gill-membranes narrowly joined at base, free from isthmus. Dorsal midway between ventrals and anal; pectoral just reaching ventral origin; ventrals not reaching anal; last simple ray of dorsal not enlarged or spiny; caudal forked, the lobes bluntly pointed. Lateral line complete, running low but terminating in center of peduncle; scales with radiating striæ and very fine irregular parallel markings.

Scales on side with faint dark margins; no other markings. A color sketch from life is olive on the back; sides and below silvery, the scales on back and sides narrowly edged with dark; vertical fins tinged with red and paired fins pale.

RASBORINUS Oshima

OSHIMA, 1920, Proc. Phila., LXXII, p. 130. Type: *Rasborinus takakii* Oshima; Ako, Formosa.

Body rather deep; jaws equal or the lower slightly the shorter; keel behind ventrals only; no dorsal spine; origin of dorsal behind ventral base; anal rather long. Lateral line dipping well down in a very even curve. Teeth 3-rowed. A few species in east China and adjacent islands.

Rasborinus hainanensis, new species

DESCRIPTION OF TYPE.—Number 8382, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 95 mm. Depth in length 3.2; head 3.8. Eye in head 3.8; snout 4; interorbital 3.2; maxillary 3.2; depth of peduncle 2.3; its length 2.3; pectoral 1.5; ventral 1.7; longest dorsal ray 1.6; longest anal ray 2.

Dorsal 9; anal 19. Scales 41. Teeth 3-rowed, 5, 4, 2; stout, smooth, tips slightly bent.

Deep and compressed; interorbital gently convex; back somewhat elevated; a naked keel from ventrals to vent, which however is crossed by 2 or 3 scales at its

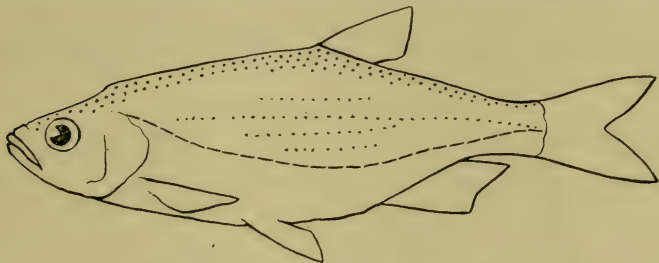


Fig. 40. *Rasborinus hainanensis*, type. 95 mm. without caudal.

front end; breast rounded. Mouth strongly oblique; somewhat curved, the lower jaw slightly included; upper jaw protractile; maxillary barely to under front of eye; no barbels; a groove across snout before nostril; gill-membranes delicately joined to isthmus under hind margin of eye. Dorsal and anal without spinous rays; dorsal origin equidistant from base of caudal and edge of preopercle; ventral origin about equidistant from tip of snout and axil of anal; pectoral blunt, not reaching ventral; ventral reaching about half-way to anal; caudal forked. Scales with radiating striæ; lateral line complete, much decurved, rising on peduncle to end near its center; a pointed ventral axillary scale, and also a narrow specialized scale under the lower axil of ventral; anal with a conspicuous basal sheath of scales.

Brownish; dark along back; faint narrow horizontal dark streaks following rows of scales along side above lateral line.

This is very likely what Oshima (1926) identifies with *Rasborinus takakii* Oshima from Formosa.

Rhodeinæ

Usually small, deep-bodied compressed fishes; one or more initial smooth spines variously developed or absent in the dorsal and usually in the anal to correspond, a pair of barbels present or absent; ventral bases close to the anal origin; the vent placed well forward between them, this character associated with the presence of an external ovipositor

with which the female is known in some forms to place her eggs in the mantle cavity of fresh-water mussels. Mouth small, the lower jaw usually slightly included, and the snout somewhat swollen and pimply in males, overhanging the mouth. Teeth one-rowed, 5. A small closely related Eurasian group, with a widely distributed species in Europe and numerous species in the Orient.

ACANTHORHODEUS Bleeker

BLEEKER, 1870, Vers. Akad. Amsterdam, (2) XV, p. 253. Type: *Acanthorhodeus macropterus* Bleeker.

Dorsal and anal with two or three initial spines more or less developed; small barbel present or absent; lateral line complete; teeth serrate.

***Acanthorhodeus tonkinensis* Vaillant**

Acanthorhodeus tonkinensis VAILLANT, 1892, Bull. Soc. Phil. Paris, 1891-92, p. 127. Upper Tonkin. BERG, 1907, Annals and Mag. of Nat. Hist., XIX, p. 162.

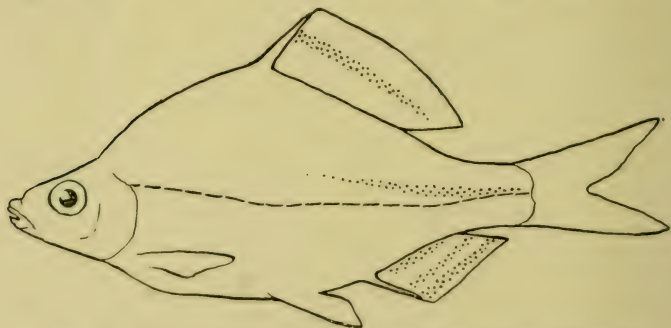


Fig. 41. *Acanthorhodeus tonkinensis* Vaillant. 77 mm. without caudal.

Head 4 in length to base of caudal; depth 2 to 2.1.

Dorsal with 13 to 15, anal with 11 to 12 soft rays; scales 36.

A minute barbel present. Teeth in one row, 5, with flat bevelled inner face one edge of which is somewhat serrate. Dorsal and anal spines well developed though with slender perfectly filamentous tips. Lateral line complete, very slightly bent down.

Two dark lengthwise stripes on dorsal and anal more or less distinct.

This seems to be the southern representative of *Acanthorhodeus guichinoti* (a common species widely distributed in central China). It is probably what Oshima (1926) has described as *Acanthorhodeus longispinus* from Kachek, Hainan.

RHODEUS Agassiz

AGASSIZ, 1835, Mem. Soc. Nat. Neuf., I, p. 37. Type: *Cyprinus amarus* Bloch.

No barbels. Lateral line incomplete. Teeth not serrate. Dorsal and anal usually rather short.

***Rhodeus spinalis* Oshima**

Rhodeus spinalis OSHIMA, 1926, Annot. Zool. Japon., XI, p. 16, Kachek River, Hainan.

Length 78 mm. Depth in length 2; head 4.15. Snout in head 3. Eye 3; interorbital 3; pectoral 1.25; ventral 1.5; depth of peduncle, 1.88. Dorsal rays II, 10; anal II, 14. Scales 34. Black "rhodein" streak present, vertical fins dusky.

Distinguished from other members of the genus by the presence of osseous dorsal and anal spines.

PSEUDOPERILAMPUS Bleeker

BLEEKER, 1863, Neder. Tijdschr. Dierk., I, p. 214. Type: *Pseudoperilampus typus* Bleeker.

Lateral line incomplete; no spines in dorsal and anal, and no barbels; teeth one-rowed, 5, serrated. Deeper, more compressed, and smaller scaled than *Rhodeus*, with more rays in dorsal and anal.

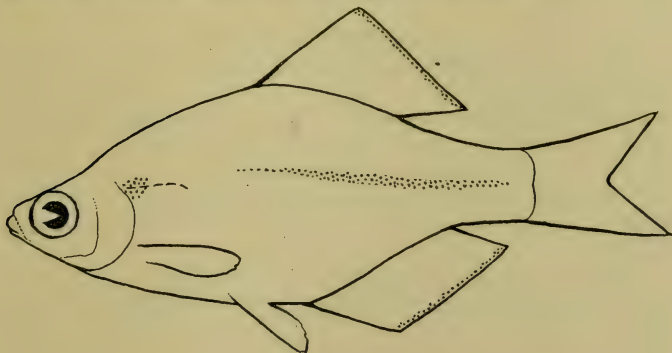


Fig. 42. *Pseudoperilampus hainanensis*, type. 39 mm. without caudal.

***Pseudoperilampus hainanensis*, new species**

DESCRIPTION OF TYPE.—Number 8386, American Museum of Natural History. Locality: Nodoa, Hainan, February 27, 1923. Length to base of caudal 39 mm. Depth in length 2.3; head 3.9. Eye in head 2.5; snout 4; interorbital 2.4; width of mouth 4.4; depth of peduncle 1.7; length of peduncle 1.3; pectoral 1.3; ventral 1.8; longest dorsal ray 1.2; longest anal ray 1.3; caudal lobe 0.7.

Dorsal 14; anal 18. Scales 34.

Body deep and compressed; profile concave over the eye; top of head flat; breast not keeled. Mouth very small, curved, inferior; maxillary not reaching orbit; no barbels; mouth overhung by a double warty hood on tip of snout; also a line of warts passing over the large double nostril (with flap between) to the eye; gill-membranes narrowly joined to the isthmus. Ventrals approximate; the dorsal inserted over their middle; pectoral just reaching ventral; ventral just reaching anal; first two (simple) rays of dorsal and anal slender, stiffened at base soft at tip. Body covered with medium sized narrow scales which have radiating striae; lateral line on about anterior 5 only.

A black streak in center of tail region; dorsal and anal narrowly edged with black; no other markings. A color sketch from life is dark silvery on the body tinged with purple; a narrow blue stripe in the center of the tail region; dorsal and anal tinged with purplish pink with narrow blackish margins; the dorsal also with a vague dark central band; caudal pale, its middle rays bright red.

PÆCILLIIDÆ. The Tooth-Carps

Small fishes of temperate and tropical fresh, brackish and salt water. A single small, dorsal fin without spines placed posteriorly. Mouth small, oblique transverse with small teeth, the lower jaw projecting. Few species in Asia, a moderate number in the Indian region and in Africa, the group best developed in middle America.

APLOCHEILUS McClelland

McClelland, 1839, 'Ind. Cyprin.,' p. 301. Type: *Aplocheilus melastigmus* McClelland.

Anal fin unmodified; ventrals present; teeth pointed; in a narrow band.

Aplocheilus curvinotus, new species

Premaxillaries not protractile; orbital rim adnate or with a very slight fold; teeth small, pointed, in a single irregular series or very narrow band.

DESCRIPTION OF TYPE.—Number 8398, American Museum of Natural History. Locality: Nodda, Hainan. Length to base of caudal 23 mm. Depth in length 3.4; head 3.4. Eye in head 2.6; snout 4; interorbital 2; width of mouth 2.5; width of body 1.6; depth of peduncle 2.3; its length 2.4; pectoral 1.2; ventral 2.4; longest dorsal ray 1.5; longest anal ray 1.6; caudal 1.3.

Dorsal 6; anal 25. Scales about 35.

Compressed; the head broad and wedge-shaped, flat forward, flattened above and below; belly narrow, vent immediately before anal origin. Mouth small, transverse, directed upwards; the lower jaw projecting; interorbital broad and flat; eye large, somewhat infralateral; gill-membranes narrowly joined under hind margin of eye, free from isthmus. Dorsal far back, its origin nearer caudal base than to anal origin, its tip when depressed reaching caudal base; anal long, its origin equidistant from the base of caudal and center of eye; ventrals short, extending $\frac{2}{3}$ the distance to

anal; pectoral placed high and directed somewhat upward; caudal slightly emarginate. No evident lateral line.

Top of head dark, and center of back with a dark streak. A dark streak in the center of peduncle extending forward half the length of the fish above the center of side. Viscera showing through, dark.

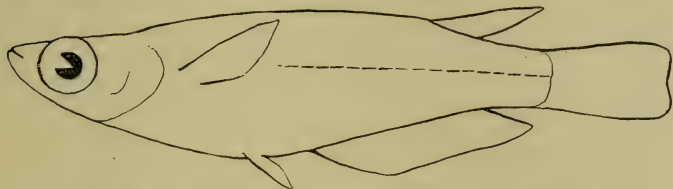


Fig. 43. *Aplocheilus curvinotus*, type. 23 mm. without caudal.

The greater number of anal rays separate this species from *A. latipes* of Japan and Formosa, type of *Oryzias* which should probably stand as a subgenus to include *curvinotus* also. In recording *Oryzias latipes* from Kachek, Hainan, Oshima (1926) probably confused *curvinotus* therewith.

AMBASSIDÆ. The Ambassids

Small, perch-like fishes, with body elevated, compressed, more or less diaphanous. Lower limb of preopercle with a double serrated edge, opercle without prominent spine. A forwardly directed recumbent spine in front of the dorsal. Spinous and soft dorsals distinct or with slight connection at the base; anal with 3 spines. Caudal well forked. Mouth oblique, the lower jaw projecting. Scales smooth, rather small, frequently deciduous.

AMBASSIS Cuvier and Valenciennes

CUVIER AND VALENCIENNES, 1828, 'Hist. Nat. Poiss.,' II, p. 175. Type: *Centropomus ambassis* Lacépède (*Ambassis commersoni* Cuvier and Valenciennes).

Ambassis gymnocephalus (Lacépède)

Lutjanus gymnocephalus LACÉPÈDE, 1802, 'Hist. Nat. Poiss.,' III, Pl. XXIII, fig. 3.

Dorsal rays VII-I, 9 to 10; anal III, 9 to 10. Scales 27 to 29. Interopercle not serrated; lateral line interrupted; two rows of scales on suborbitals.

A widely distributed coastal species from east Africa to the Malay Peninsula. Sometimes entering fresh water, and recorded from the Kachek River, Hainan by Oshima (1926).

SERRANIDÆ. The Sea Basses

Symmetrical, rather large-mouthed fishes with a spiny anterior and soft-rayed posterior portion to the dorsal fin, the two usually, not always, connected at the base. Eye moderate in position and size. Pseudobranchiæ well developed. Ventral fins without a scaly flap at their base. Upper corner of operculum with one or two more or less obscure flattened spines. The fins not densely scaled, lateral line not extending across the caudal. Ventral fins usually inserted slightly behind the pectorals, their rays regularly I, 5. Scales moderate or small, more or less rough. Teeth pointed, in bands, some of them generally hinged. Caudal rounded, squarish, or weakly forked.

Sea basses are dominant, specialized, spiny-rayed shore fishes of temperate and warm temperate seas. A few genera run into fresh water or occur exclusively in fresh water.

LATES Cuvier and Valenciennes

CUVIER AND VALENCIENNES, 1828, 'Hist. Nat. Poiss.,' II, p. 88. Type: *Perca nilotica* LINNÆUS.

Large fishes with spinous and soft dorsal fins separate, rough scales of moderate or small size, rounded caudal, three anal spines, large oblique mouth, eye far forward. Teeth villiform; preorbital and shoulder bone serrated; preopercle with strong spines at its angle, and denticulated along its horizontal border; opercle spiny.

Lates calcarifer (Bloch)

Holocentrus calcarifer BLOCH, 1785, 'Ichthyologie,' Pl. ccxliv.

Depth in total length (with caudal) 3.5 to 3.7; head 3.7 to 4. Eye in head 5 to 6; snout 4; maxillary 2.4.

Dorsal rays VII to VIII-I, 10 to 12; anal III, 8 to 9. Scales 52 to 60. Dorsal spines strong, the third the highest.

Mouths of rivers in the Indian Ocean. Recorded by Oshima (1926) from the Kachek River, Hainan.

COREOPERCA Herzenstein

HERZENSTEIN, 1896, Ann. Ac. St. Petersburg., p. 11. Type: *C. herzi* Herzenstein.

This genus is characterized as follows by Boulenger:

Body compressed; scales small, cycloid, concentrically striated. Lateral line complete; tubes straight, occupying the greater length of the scale. Mouth large, protractile; maxillary exposed, with supplemental bone; villiform teeth in jaws and on vomer and palatines; no canines; tongue smooth; head partly naked; preopercle serrated, with a few antrorse spines on the lower border; opercle with two spines. Gill-membranes separate; seven branchiostegals; pseudobranchiæ present. Dorsal

fins confluent, XIV-XV, 11-14, the spinous portion much longer than the soft; anal short, III, 7-11; caudal rounded. Pectoral symmetrical, ventral with a strong spine and five branched rays, the last of which is connected with the belly by a membrane.

One species from North Korea and one from Hainan.

***Coreoperca whiteheadi* Boulenger**

Coreoperca whiteheadi BOULENGER, 1899, Proc. Zool. Soc. London, pt. 2, p. 960.

A small perch-like fish with ocellus on opercular flap.

Description based on a small specimen 68 mm. in length to base of caudal, Nodoa, April 6, 1923:

Depth in length 2.6 (to 3); head 2.3 (to 3). Eye in head 4; snout 4; interorbital 4.5; maxillary 2.4; depth of peduncle 3; pectoral 2.2; ventral 2; its spine 3.5;

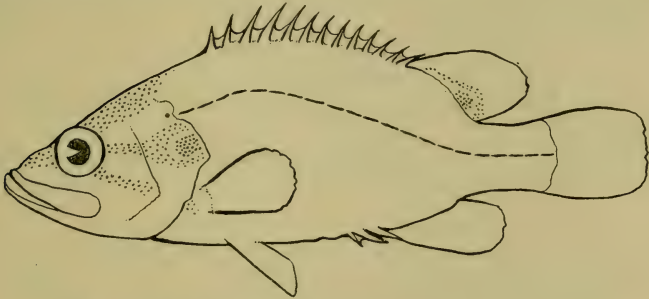


Fig. 44. *Coreoperca whiteheadi* Boulenger. 97 mm. without caudal.

longest dorsal spine 3; dorsal ray 2.5; longest anal spine (2nd) 4; anal ray 2.5; caudal 1.8. Base soft dorsal in base spinous 2.

Dorsal XIV, 17 (to XV, 14); anal 12 (to 11). Scales about 70 (to 80).

Snout pointed; lower jaw projecting; eye with a free rim, impinging on profile; interorbital flat or slightly concave; preopercle finely serrate, serrations a little coarser on angle and lower limb; opercle with a small sharp spine crossing a black ocellus on the flap. Gill-membranes free and independent. Dorsal and anal spines with cutaneous scaled sheaths at base, soft rays without sheath; caudal rounded subtruncate. Body covered with small cycloid scales with prominent concentric ridges; breast and cheek with smaller scales; a few scales on opercle; none on interorbital, top of snout, jaws and gill-membranes.

Color dark, with vague irregular pale mottling, breast paler. Two dark radiating stripes downward and backward from eye. Spinous dorsal dusky; ventral dusky with a broad pale edge; pectoral hyaline; soft vertical fins pale with dusky marks at the bases.

A color sketch from life is irregularly blotched, vermiculated with bluish greenish on a blackish ground; the mid-line of the head above, to include the first two dorsal

spines, and the top of the peduncle light brown; two dark stripes radiating backward from the eye; a dark blue blotch with a narrow pale margin on the corner of the opercle; paired fins more or less dusky; spinous dorsal more or less black and the other vertical fins pale grayish.

This fish seemed to be rare immediately about Nodoa but common in streams of the low country some miles to the west. My fisherman knew these streams and could get the fish only by going there.

OPHIOCEPHALIDÆ. The Snake-heads

Body elongate, subcylindrical anteriorly, head more or less depressed. Mouth large. A single long spineless dorsal fin and similar though shorter anal. Body covered with small concentrically striate or embossed scales; lateral line abruptly curved or almost interrupted. Ventral fins thoracic or absent. Fresh-water fishes of southern Asia, the Indies, and 1 or 2 species in Africa.

OPHICEPHALUS Bloch

BLOCH, 1794, 'Ausländischen Fische,' VIII, p. 137. Type: *Ophicephalus punctatus* Bloch.

Ventral fins present. A number of species in southern Asia and the Indies, and 1 or 2 species in Africa.

Ophicephalus maculatus (Lacépède)

Bostrychus maculatus LACÉPÈDE, 1802, 'Hist. Nat. Poiss.,' III, pp. 140, 143.

Ophiocephalus maculatus GÜNTHER, 1861, 'Cat.,' III, p. 480.

Description of a specimen from Nodoa, July 19, 1923:

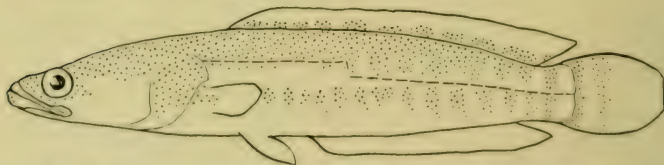


Fig. 45. *Ophicephalus maculatus* (Lacépède). 110 mm. without caudal.

Length to base of caudal 110 mm. Depth in length 5.1; Head 2.7. Eye in head 6.6; snout 4.9; interorbital 4.9; maxillary 2.6; depth of peduncle 3.4; width of body 2.3; pectoral 3.7; ventral 3.4; height (posterior) dorsal lobe 3.3; anal lobe 3.3; caudal 1.8.

Dorsal 46; anal 30. Scales 55.

Lower jaw projecting; snout and interorbital low, flat, orbital rim slightly raised; margin of eye free; maxillary extending slightly beyond eye; gill-membranes joined at base, free from isthmus. Body little compressed in front, well compressed behind.

Pectoral extending beyond ventral origin; ventral not reaching anal; dorsal inserted behind pectoral base; anal origin equidistant from base of caudal and center of eye; axil of dorsal behind that of anal. Body and head covered with small striate scales, except snout, jaws, and chin; scales extending forward on mid-line of snout above to a distance equal $\frac{2}{3}$ of eye from tip of snout; lateral line complete; dropping 2 scale rows over front part of anal.

Base of caudal and peduncle with vague alternating pale and dark crossbands; a double row of dark marks forward on side; a dark line slanting down from back of eye; dark marks along the base of the dorsal. A color sketch from life is dark brown on the back; bluish silvery on the sides and below; a double row of closely spaced dusky blotches along the side, the upper carried forward from the angle of the gill-cleft to the eye as a dusky band, narrowing before the eye as a dusky stripe to the end of the lower jaw; irregular radiating streaks below the eye; two complete dusky bands crossing the peduncle and the base of the caudal; a reddish band between them and another behind the last; fins brownish; the paired fins tinged with orange at the base; dorsal with a series of dusky blotches on its base, and anal more or less dusky at the tip.

***Ophicephalus gachua* Hamilton-Buchanan**

Ophiocephalus gachua HAMILTON-BUCHANAN, 1822, 'Fishes of the Ganges,' p. 68; WEBER AND DE BEAUFORT, 1922, IV, p. 321.

An *Ophiocephalus* with barred fins (in the young) and very broad head, the upper surface of which covered with rather large shields.

Description of a small specimen from Nodoa, March 9, 1923:



Fig. 46. *Ophicephalus gachua* Hamilton-Buchanan. 120 mm. without caudal.

Length to base of caudal 50 mm. Depth in length 5.5; head 3.2. Eye in head 5.3; snout 5.3; interorbital 3; maxillary 3; width of head 1.7; depth of peduncle 3.1; pectoral 1.5; ventral 3; height of (posterior) dorsal lobe 3; anal lobe 2.7; caudal 1.2.

Dorsal 32; anal 22. Scales 40.

Head broad, depressed; body compressed behind. Lower jaw slightly projecting; maxillary not quite to posterior edge of eye; nasal tube long; eye with a free rim; gill-membranes joined, free from isthmus. Dorsal and ventral origins apposed, a short distance behind base of pectoral; anal origin equidistant from tip of maxillary and base of caudal; dorsal axil behind anal; caudal rounded, subacuminate. Body and head covered with striate scales, absent before the eye, on tip of snout, jaws and chin; lateral line complete, dropping down a single scale row at tip of pectoral.

Brownish olive, paler along belly; sides faintly chequered; faint dark bars slanting forward and downward on back; a short bar above and a streak behind tip

of maxillary; ventrals pale, other fins barred. A color sketch from life of this small specimen is brownish, more or less mottled; the body crossed by vague zigzag blackish bands; the lower side of the head varied light and dark; pectoral, dorsal, caudal and anal fins barred; eye, and a short bar near the base of the pectoral reddish.

A somewhat larger individual of 120 mm. has head 3; caudal in length 4.5 (5.5 in total); width of head 1.5 in its length, interorbital 3.5. Maxillary to under posterior edge of eye; a few teeth at side of lower jaw somewhat enlarged. Pectoral not quite to vent, more than twice length of ventral. Shields on upper surface of head rather large. Head and body dark colored; dorsal and anal dusky with a narrow whitish margin; caudal dark gray; pectoral gray with 2 or 3 narrow dark bars basally.

This species is listed from British India and Ceylon, Borneo, Java, Sumatra, Malay Peninsula, and Siam. Our two specimens agree particularly well with *Ophicephalus kelaartii* from Ceylon, synonymized with *O. gachua* by Weber and de Beaufort.

CHANNA Scopoli

Channa (Gronow, 1763, 'Zoophylaceum') SCOPOLI, 1777, 'Int. Hist. Nat.,' p. 459. Type: *Channa orientalis* Bloch and Schneider.

Ventral fins absent. A single, or two or three closely related species in southern and eastern Asia.

Channa ocellata Peters

Channa ocellata PETERS, 1864, Monatsh. Acad. Wiss. Berl., p. 384. China.

Description from a small specimen (87 mm. to base of caudal) from Tungting Lake, Hunan. (Hainan material is indistinguishable):

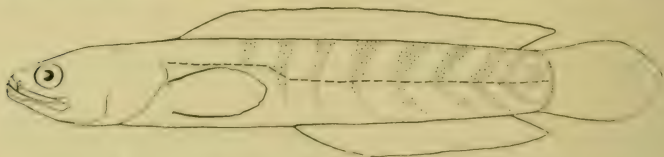


Fig. 47. *Channa ocellata* Peters. 143 mm. without caudal.

Depth in length 6.2; head 3.3. Eye in head 5.2; snout 4.8; interorbital 3.8; maxillary 2.5; depth of peduncle 2.7; pectoral 1.7; middle dorsal rays 2.8; middle anal rays 3.5; caudal 1.5.

Dorsal 46; anal 28. Scales 60.

Depressed in front, compressed behind. No ventrals. A conspicuous nasal tube on side of snout; lower jaw slightly projecting. Body and head, except snout, chin and jaws, scaled. Scales sculptured with more or less parallel concentric wavy ridges. Lateral line complete, starting high, descending gently to center of side behind tip of

pectoral. Dorsal commencing behind base of pectoral. Peduncle short but evident, dorsal axil appreciably behind anal. Gill-membranes rather broadly joined, free from isthmus. Maxillary to or beyond posterior edge of eye.

Dark on top of head, pale brown on belly, sides posteriorly with V-shaped cross-bars, black ocellus at base of caudal.

A color sketch from life is as follows:—body and fins coppery olive; body crossed with irregular dark blue bands, more or less horizontal on the head behind the eye; vertical and curved on the body, to end in an oval ocellated blotch at the base of the caudal; body with points of red; head, body and dorsal with numerous scattered chalky white specks. In another sketch the bands on head and sides are black, the ocellated blotch at the caudal base dark blue bordered with orange, a blotch at the shoulder dark blue narrowly bordered with white; and the iris orange.

ANABANTIDÆ. The Labyrinth Fishes

Dorsal and anal fins of a variable number of spines and rays. Scales small or of moderate size, ctenoid; lateral line interrupted or absent. A cavity above the third or upper portion of the first branchial arch contains an elaborate apparatus consisting of thin laminae of bone, covered by a vascular mucous membrane, and employed as an auxilliary organ of respiration. Fresh-water and estuary fishes of southern Asia and of Africa.

MACROPODUS Lacépède

LACÉPÈDE, 1802, 'Hist. Nat. Poiss.,' III, p. 416. Type: *Macropodus viridiauratus* Lacépède.

No teeth on the palate; ventral I, 5; dorsal and anal spines much more numerous than the rays. Small highly colored fishes, a few species in southern and eastern Asia and adjacent islands.

Macropodus viridiauratus Lacépède

Macropodus viridiauratus LACÉPÈDE, 1802, 'Hist. Nat. Poiss.,' III, p. 416.

Description of a specimen from Nodoa, March 14, 1923:

Length to base of caudal 36 mm. Depth in length 2.8; head 2.8. Eye in head 3.9; snout 3.9; interorbital 3; maxillary 3.9; depth of peduncle 2; pectoral 1.2; ventral 0.8; last dorsal spine 2.5; last anal spine 2.5; longest dorsal ray 1.2; longest anal ray 1.1; caudal 0.8.

Dorsal XV, 8; anal XVIII, 16. Scales 35.

Body strongly compressed. Mouth small, oblique, lower jaw slightly projecting, maxillary not nearly reaching eye. Preopercle and posterior limb of preorbital finely serrate; eye with free rim; gill-membranes joined, free from isthmus. Pectoral long, narrow fan-shaped; ventral with a filamentous ray reaching soft anal; spinous dorsal and anal long, spines increasing in length backward; lobes of shorter higher soft fins

ending in filaments; axil of dorsal separated from, of anal contiguous with caudal base. Origin of dorsal and anal appreciably behind bases of paired fins, that of anal slightly the further forward. Caudal with graduated margin and forked center. Body and head covered with rough ctenoid scales, except naked preorbital; one or more broken lateral lines running high, anteriorly,—a single almost complete one posteriorly, near center of peduncle. A scaly sheath at the base of dorsal and anal.

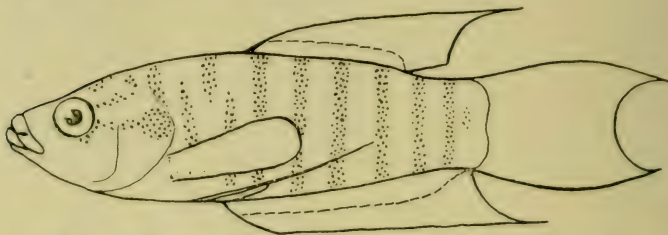


Fig. 48. *Macropodus viridiauratus* Lacépède. 36 mm. without caudal.

Two or three radiating dark lines back of eye; a black blotch on opercular angle; eight narrow vertical blackish bands on body. A color sketch from life has an olive head, red iris and blue blotch on the opercle; the body is red banded with blue; pectoral translucent; ventral filaments bright red; dorsal red at the base, bluish distally, with dark spots in the center; anal red, dusky distally; caudal red.

This fish is close to, if not identical with, material from Fukien, but quite distinct from material from Anhwei, near the mouth of the Yang-tze (*Macropodus opercularis*¹). In recording *Polycanthus operculatus* (Linnaeus) from Hainan, Oshima (1926) probably failed to differentiate *viridiauratus*.

ANABAS Cuvier

CUVIER, 1817, Règne Animal, (1st Ed.) II, p. 339. Type: *Perca scandens* Daldorff.

Teeth on the palate. Opercles and preorbital serrate.

Anabas scandens (Daldorff)

Perca scandens DALDORFF, 1797, Trans. Linn. Soc. London, III, p. 62.

Depth in total length (with caudal), 3 to 4; head 3.5 to 3.7. Eye in head 4.5 to 5; equal to or greater than the snout or than $\frac{1}{2}$ the interorbital. Dorsal rays XVII to XVIII, 8 to 10; anal IX to X, 9 to 11. Scales, 28 to 32. Caudal rounded.

Fresh waters and estuaries of India and the Malay region. Recorded by Oshima (1926) from Haiho, Hainan.

¹According to G. S. Myers [in conversation] *viridiauratus* Lacépède is a synonym of *opercularis* L., and this other form should stand as *chinensis* Bloch.

MASTACEMBELIDÆ. Spiny Eels

Compressed eel-like fishes with pointed more or less proboscis-like snout, many small sharp spines along the back, and frequently concealed spines on the side of the head. A number of species in southern Asia, the Indies, and Africa.

MASTACEMBELUS Scopoli

SCOPOLI, 1777, 'Int. Hist. Nat.,' p: 458. after Gronow. Type: *Ophidium simack* Walbaum, 1792 = *Rhynchobdella haleppensis* Bloch and Schneider, 1801 (*Mastacembelus maxillis subacutis*, Gronow).

Preorbital spine present.

***Mastacembelus armatus*, (Lacépède)**

Macrognathus armatus LACÉPÈDES, 1800, 'Hist. Nat. Poiss.,' II, p. 286.

Mastacembelus armatus BOULENGER, 1912, Journ. Ac. Nat. Sci. Phila., XV.

***Mastacembelus armatus undulatus* (McClelland)**

Macrognathus undulatus MCCLELLAND, 1844, Calcutta Journ. Nat. Hist., IV, p. 398, Pl. XXII.

Description of a specimen from Nodoa, August 2, 1923:

Length to base of caudal 160 mm. Depth in length 8.6; head 5.4. Eye in head 8; snout 3; interorbital 8; maxillary 3.6; pectoral 3.3; caudal 4; 2nd anal spine 4.5; tentacle in eye about 1; snout beyond mouth 1.5. Thickness of body 1.7 in depth.

Dorsal XXXIII, about 75; anal III, about 75 (the first spine obscure).

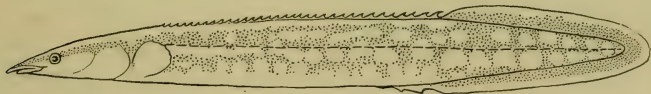


Fig. 49. *Mastacembelus armatus undulatus* (McClelland). 160 mm. without caudal.

Greatest depth of body under middle of spinous dorsal. Eye impinging slightly on profile; gill-cleft not extending above pectoral; eye without free rim; 2 preopercular spines, the upper the longer; a smaller preorbital spine. Scales very small, not evident on snout, jaws or gill-membranes, present elsewhere. Pectorals broad; dorsal spines small in front gradually increasing backward; last anal spine much the larger; first dorsal spine just behind pectoral base.

A dark band from snout through eye to dark back, and wide dark reticulations posteriorly enclosing large pale oval areas, roughly in 2 rows; fins dark, edged with whitish. A color sketch from life is pale brownish on the top of the head and on the back, including the dorsal spines; sides dark olive marked by black reticulations which are confluent anteriorly in a black band which passes forward to the eye and more narrowly from the eye to the tip of the snout; soft vertical fins around the tail black with a pale margin, this broadest, occupying most of the width of the fin, at the front of the soft dorsal; eye dull red.

This fish was common about Nodoo, though seldom taken in numbers. My fisherman was generally able to get one or two any day that he was told to do so, providing it had not rained too recently. It was only after the seventh or eighth attempt that we succeeded in keeping one alive and in good color long enough for Mr. Wang to record its form and color. A specimen would often die in less than a day after capture and its colors would change long before death.

ELEOTRIDÆ. Primitive Gobies

Small carnivorous fishes, mostly of small size, living on the bottom near shore in warm regions. Numerous in brackish as well as salt water, and some in fresh water. Body scaled; teeth weak; orbital rim adnate; dorsal fins separate, the first of a few weak flexible spines; ventral fins close together, separate, I, 5; soft dorsal and anal similar; caudal usually rounded or pointed. Opercle unarmed, preopercle frequently with a spine. Related to the true gobies (Gobiidæ) from which they differ obviously in having ventral fins separate.

PHILYPNUS Cuvier and Valenciennes

CUVIER AND VALENCIENNES, 1837, 'Hist. Nat. Poiss.,' XII, p. 255. Type: *Gobiomorus dormitator* Lacépède.

Vomer with teeth, preopercle spineless, gill openings wide, to under front part of eye. Tropical rivers.

Philypnus chalmersi, new species

DESCRIPTION OF TYPE.—Number S384, American Museum of Natural History. Locality: Nodoo, Hainan. Length to base of caudal 102 mm. Depth in length 4.8; head 3.8. Eye in head 4.6; snout 3.3; interorbital 5; maxillary 2.4; width of head 1.8; depth of peduncle 3; its length (from dorsal axil) 1.4; longest dorsal spine 2; longest dorsal ray 1.8; pectoral 1.4; ventral 1.6; longest anal ray 2; caudal 1.3.

Dorsal VIII, 13; anal 10. Scales 42.

Little compressed deepest at nape which is slightly gibbous; vent shortly before anal origin, with a large papilla behind it. Head rather pointed, its outlines gently convex; cheeks slightly swollen; mouth oblique; maxillary to under front of eye; lower jaw projecting; eye somewhat superolateral, without free rim; gill-membranes free from one another and from isthmus. Ventrals separate. Scales finely ctenoid on sides; those on breast smaller; body completely scaled; side of head scaled, interorbital snout and jaws scaleless; lateral line almost complete.

Brownish, head darker on snout, behind eye, along margin of opercle and gill-membranes. Upper parts speckled with black, dorsals and caudal finely barred.

A SMALLER SPECIMEN.—Number S385, American Museum of Natural History. Locality: Nodoo, Hainan, July 21, 1923. Length to base of caudal 58 mm. Depth in length 5; head 3. Eye in head 4.5; snout 3.2; interorbital 6.5; maxillary 2.7; thick-

ness of body 2.1; depth of peduncle 3.3; pectoral 1.6; ventral 1.6; longest dorsal spine 2.5; longest dorsal ray 2.7; longest anal ray 3; caudal 1.6.

Dorsal VIII, 12; anal 10. Scales about 40, irregular. Ventral 6.

Body little compressed, back elevated; snout rather narrow, pointed; breast and belly flattened. Lower jaw projecting; maxillary passing front of eye; gill-membranes free from one another and from isthmus; 3 or 4 rows of conspicuous pores below the eye; no spines about head. Teeth small in broad bands in jaws, the inner teeth of the upper jaw slightly enlarged and notably depressible, a curved band of fine teeth on the vomer, tongue toothless. Gill rakers well developed, lanceolate, rather short and numerous, about 15 on the lower limb of the first arch. Pectoral long and narrow with a broad base; ventral origin behind pectoral base and before origin of spinous dorsal;

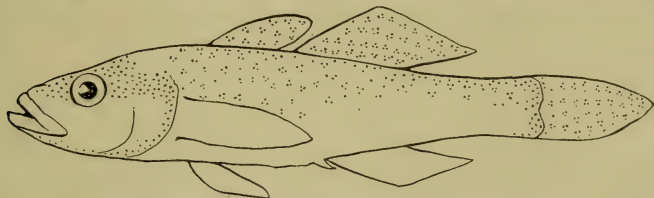


Fig. 50. *Philypnus chalmersi*, type. 102 mm. without caudal.

anal origin behind that of 2nd dorsal; caudal narrow, subtruncate; bases of ventrals separated by $\frac{2}{3}$ that of one; spines of 1st dorsal slender and soft. Body and back covered with small thin ctenoid scales, none on interorbital, snout, or jaws; lateral line somewhat obscure and broken, running straight from under pectoral and stopping a scale or two short of caudal, scales of lateral line and peduncle somewhat larger, on shoulder small and crowded.

Dark vertical mark below eye and horizontal marks along center of side. Dark spot on upper pectoral base, and band across base of caudal; caudal barred, dorsals spotted. A color sketch from life of a small specimen is: brownish, paler below; three or four vague dark areas on the back; several dark streaks radiating from the eye, and along the centre of the side; a blue spot on the opercle; a dark bar across the base of the caudal; dorsals and caudal spotted on the rays; posterior corner of the first dorsal dusky; other fins pale.

Named for Chalmers Salsbury, son of Dr. Clarence G. Salsbury.

ELEOTRIS GRONOW

GRONOW, 1763, Zoophylaceum, p. 83. BLOCH AND SCHNEIDER, 1801. Type: *Gobius pisonis* Gmelin.

Vomer without teeth; preopercle with a concealed spine; isthmus wide, gill openings extending no farther forward than posterior angle of preopercle.

Eleotris oxycephala, Temminck and Schlegel

Eleotris oxycephala TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 149, Pl. LXXVII, fig. 4 and 5. Japan.

Depth in length 6; head 4; eye in head 5.5; snout, 5; interorbital 3.7; maxillary 2.6. Lower jaw strongly projecting. Dorsal VI, 9; anal 9.

Recorded by Oshima (1926) from Haiho and the Kachek River, Hainan. The species is close to and may have been confused with *Eleotris balia* Jordan and Seale from China, probably Hongkong.

Gobiidæ. The Gobies

A large family of small, bottom fishes, everywhere abundant in warm seas. Allied to the more primitive Eleotridæ but with ventral fins united.

Gobius Linnæus

LINNÆUS, 1758, 10th Ed., I, p. 263. Type: *Gobius niger* Linnæus.

Dorsal fins separate, free from the caudal; ventral disk free from the belly; dorsal spines 6; eyes well developed; teeth simple; body with more or less ctenoid scales; interorbital area without fleshy crest and inner edge of shoulder girdle without fleshy cirri or papillæ.

A large cosmopolitan genus, mostly marine but occurring also in fresh water. Recently much divided, the divisions best recognized as subgenera.

Subgenus **RHINOGOBIUS** Gill

One or more species of small fishes representing this subgenus occur in most of the fresh waters of eastern Asia.

Gobius hadropterus (Jordan and Snyder)

Ctenogobius hadropterus JORDAN AND SNYDER, 1902, Proc. U. S. Nat. Mus., XXIV, p. 60. Japan.

We have several small specimens from Nodoo, mostly under 35 mm. in length to base of caudal, provisionally identified with this Japanese species. They have the caudal crossed by narrow dark bars.

A larger specimen from Fukien may be described as follows:

Length to base of caudal 65 mm. Depth in length 5; head 3.2. Eye in head 5; snout 2.5; maxillary 2.1; width of head 1.6; depth of peduncle 2.6; its length 1.3; pectoral 1.3; ventral 1.6; longest dorsal spine 2.3; longest dorsal ray (last) 1.3; longest anal ray (last) 1.5; caudal 1.3. Interorbital in eye 1.5.

Dorsal VI, 9; anal 9. Scales 30.

A little depressed in front, compressed behind; lower surface of head and breast flattish, sides above then sloping to mid-dorsal line; vent situated behind a flat flap, almost immediately before anal origin. Cheeks swollen; eyes superolateral, close

together; interorbital a little concave; mouth very slightly oblique; lower jaw very slightly included; maxillary to under front of pupil; lips broad. Ventral origin a little behind pectoral base, slightly before origin of dorsal; pectoral reaching almost to over anal origin, ventral not reaching quite so far back; caudal pointed; ventrals united into a disk, free behind, with a rounded tip, its anterior flap truncate in the center with pointed exerted corners. Scales more or less pointed; with comb edges and converg-



Fig. 51. *Gobius hadropterus* (Jordan and Snyder). 38 mm. without caudal.

ing striae; small and imbedded on the belly; lateral line very little developed, on the tail only. Orbital rim adnate above with a rather deep fold below; Gill-membranes broadly joined to side of breast beneath branchiostegals under edge of preopercle.

A small dark mark at upper corner of pectoral base, and on base of the central caudal rays; snout faintly vermiculated; fins grayish, dorsal and anal lobes dusky. Several other specimens from Fukien, mostly a little smaller with pale fins.

This species has previously been listed from China by Rendahl (1924, Arkiv for Zoologi, Stockholm, XVI, p. 18).

***Gobius giurinus* Rutter**

Gobius giurinus RUTTER, 1897, Proc. Acad. Phila., XLIX, p. 86. Swatow.

Recorded by Oshima (1926) from the Kachek River, Hainan. If we are correct in identifying with this species a specimen 75 mm. in standard length from Fukien, it is close to *Gobius hadropterus*. At this size the soft dorsal and anal are less high, their longest rays contained respectively 1.7 and 1.8 in the head. The head is less deep, more pointed, the lower jaw distinctly included instead of very slightly so; peduncle more slender. Depth 5; head 3.3. Eye in head 4.5; snout 2.7; maxillary 2.4; depth of peduncle 3.4; its length 1.1. Dorsal rays, VI, 10; anal 8. Scales 32.

***Gobius hainanensis* (Oshima)**

Rhinogobius hainanensis OSHIMA, 1926, Annot. Zool. Japon., XI, p. 23. Kachek River, Hainan.

Length 104 mm. Depth 4.59; head 3.90; depth of peduncle 7.8. Eye in head 4; snout 3.35; interorbital 4; maxillary 2.65. Dorsal rays VI, 11; anal 11. Scales 50. Mouth slightly oblique; jaws subequal, the lower very slightly projecting. Ventrals extending as far back as pectorals, not reaching vent. Body with uniform, conspicuous scales, those on the nape small, breast anterior to ventrals almost naked. Back maculated with black; sides with about 10 dark V-shaped cross-bands, the angle of

which is directed backward. A dark triangular blotch below the eye; dark brown spot at upper part of pectoral base; dorsal banded longitudinally; anal membrane dark gray.

Subgenus *Glossogobius* Gill

Gobius brunneus Temminck and Schlegel

Gobius brunneus TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 142, Pl. LXXIV, fig. 2. Japan.

Depth in total length (with caudal) about 6; head 4 plus. Eye in head 6.7; snout 3.5. Lower jaw projecting. Dorsal rays VI, 10; anal 8. Scales about 32. Color brownish, without bold markings.

This member of the subgenus (*Glossogobius*) is recorded by Oshima (1926) from Kachek River, Hainan.

Gobius grammepomus Bleeker

Gobius grammepomus BLEEKER, 1849, Verh. Bat. Gen., XXII, p. 34. East Indies.

Depth in total length 5.5 to 7.5; head 4 to 4.7; caudal rounded 5 to 5.5. Eye in head 4 to 5; snout longer than eye. An oblique streak from the eye to the maxillary. Dorsal rays VI, 10; anal 10. Scales 50 to 55.

Recorded by Oshima (1926) from Kachek River, Hainan.

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PLATE XXVI

PLATE XXVI.

In color, from life.

- Fig. 1. *Misgurnus mizolepis hainan*, type.
- Fig. 2. *Nemacheilus pulcher*, type.
- Fig. 3. *Sarcocheilichthys hainanensis*, type.
- Fig. 4. *Aphyocypris normalis*, type.



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HACKBERRY SEEDS FROM THE PLEISTOCENE LOESS OF NORTHERN CHINA¹

BY RALPH W. CHANEY

The occurrence of seeds of *Celtis* in the Pleistocene loess of western Chihli Province, China, is of particular interest in view of their presence in deposits of the same age in southern California and in the Great Plains of North America. The record of this material from the loess of northern China has especial significance since it furnishes the only known evidence regarding the plant life of this region during the Pleistocene. The seeds were collected by Professor George B. Barbour of Yenching University in 1924, and were given to the writer for study the year following. They are here described as a new species, named in honor of their collector.

Celtis barbouri, new species

DESCRIPTION.—Nutlets spheroidal, the outer portion, representing the fleshy layer, shrunken to form reticulate ridges of which the more conspicuous are longitudinal; slightly flattened at the base where an inconspicuous attachment scar can be seen in many specimens, and produced into a short stout point at the distal end; diameter 3.5 to 4.5 mm., averaging 4 mm.; thickness of the shrunken fleshy layer 0.3 mm.; interior hollow in all specimens examined.

These seeds closely resemble the specimens described by the writer from the White River beds of South Dakota under the name *Celtis hatcheri*.² They average smaller in size, and the surface markings are less well defined than is the case in the American material. In view of these differences, and more especially of the fact that living species of the genus are given distinct names in North America and in eastern Asia, it has seemed desirable to consider the specimens from Chihli as representing a distinct species.

LOCALITY.—Gully south of Kuo Ts'un, 5 miles south of Hsuan-hua-fu, and nearly 25 miles southeast of Kalgan, Chihli Province.

COLLECTION.—Univ. Calif. Coll. Pal. Bot., Type No. 154.

In discussing the *Celtis* material from the Tertiary of North America the writer has considered the ecological significance of the occurrence of

¹Publication of the Asiatic Expeditions of The American Museum of Natural History, Contribution No. 73

²Chaney R. W., 1925, Carnegie Inst. Publ. 349, No. 3 pp. 54-56

hackberry seeds.¹ Their presence in rocks which contain no other fossil plant material, together with the habit of present-day species of *Celtis*, is indicative of semiarid conditions. In both the later Tertiary and the Pleistocene deposits of the Great Plains, the only known fossil plants represent seeds and stems and are of rare occurrence.

In the asphalt deposits at Rancho La Brea, California, which contain an abundant and varied mammalian fauna of Pleistocene age, a single seed of *Celtis* has recently been noted.² The floral assemblage at this locality is dominated by juniper, live-oak (*Quercus agrifolia*), and other species now found living in regions of comparatively low rainfall. In such a situation, *Celtis* might be expected to have occurred during the Pleistocene, as it does today, occupying the borders of intermittent streams in the grasslands.

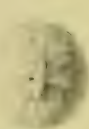


Fig. 1.



Fig. 2.

Figure 1. Seed of *Celtis barbouri* viewed from the distal end. X 4.
Figure 2. Seed of *Celtis barbouri* viewed from the side. X 4.

A similar habitat may be postulated in northern Chihli during the Pleistocene, involving a climate which is in accord with the generally accepted idea for loess accumulation, and which is not greatly unlike that found in the region today. The common living trees noted in this region by the writer are *Ulmus pumila* L. and *Populus* (probably *P. tomentosa* Carriere), both of which occupy valleys. *Ulmus pumila* ranges northward for several hundred miles across the grasslands of Inner Mongolia. *Celtis bungeana* Hems. is also recorded in northern Chihli.³ With the present annual rainfall of about 15 inches, the water table is doubtless too low to permit the forming of leaf impressions: and the seeds of *Celtis* alone, because of their larger size and thicker pericarp than those of *Ulmus* and *Populus*, are suited to remain in the sedimentary record. It is therefore suggested that conditions not unlike those of today have characterized northern Chihli as far back as Pleistocene time, and that these seeds of *Celtis* represented the only element of a rather sparse flora which was structurally suited to leave a record in the loess.

¹Op. Cit.

²Frost, 1927, Univ. Calif. Publ. in Botany, Vol. 13, No. 21.

³Sargent, 1916-1917, Plantae Wilsonianae, 111, 270.

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LAGOMORPHS COLLECTED BY THE ASIATIC EXPEDITIONS¹

BY GLOVER M. ALLEN

The fine series of lagomorphs secured by the Asiatic Expeditions, under the leadership of Dr. Roy Chapman Andrews, includes some 85 hares from such widely separated localities as Mongolia and the Chinese provinces of Shensi, Chihli, Fukien and Yunnan, as well as 136 skins of mouse-hares or pikas chiefly from the Gobi Desert region. The latter appear to represent four well-marked types of which two, *Ochotona pallasii* and *O. dauurica*, are characteristic of the Gobi; a third, *O. hyperborea mantchurica*, is more northern, reaching the edge of the Mongolian plateau; while the fourth type is more characteristic of the high mountains of western China and is allied to the small brown species, *O. tibetana*. The large number of hares available has led me to attempt a revision of the Chinese forms of the black-tailed group to the extent of indicating their subspecific relationship and allocating some of the names previously applied. The harsh-haired rabbit, *Lepus sinensis*, is now referred to the genus *Caprolagus* and a new race is described from the mountains of northwestern Fukien; while from western Yunnan is described a new species of hare allied to *Lepus nigricollis* of India.

***Ochotona hyperborea mantchurica* Thomas**

Ochotona (Pika) hyperborea mantchurica THOMAS, 1909, Ann. Mag. Nat. Hist., (8) IV, p. 504.

A small species, with palatal and incisive foramina separate. Thomas has described the race of eastern Manchuria as slightly larger and brighter russet in color than specimens from the upper Amur region representing Schrenck's *O. h. cinereo-fusca*, and at the same time suggests that these may be a species distinct from *O. hyperborea*, though closely allied to it. The skulls of the latter are much smaller (skull length 31 as against about 40 mm.) and the summer pelage is apparently grayer.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 74.

A series of over thirty skins was taken at a locality 45 miles north-east of Urga, Mongolia, by the Asiatic Expeditions. These average a very little smaller in measurements than those given for the Manchurian race, but the largest individuals are scarcely inferior to the latter, so that without Manchurian specimens for comparison they seem best considered identical. The presence of a colony of this boreal species near Urga brings its range well to the westward and carries its southern limit to the northern edge of the Gobi Desert. Most of the adults taken July 25-29 have acquired the bright russet pelage of summer though a few still retain on the rump and flanks a remnant of the longer winter fur of a pale ochraceous and black, while in one taken September 11 the new winter coat is coming in on the head, shoulders, and anterior back. The immature individuals of late July are in a dark gray pelage much intermixed with black, while adults are bright russet above, darkened on the middle of the back by black hairs, and on the belly the light tips of the hairs are washed with rusty.

***Ochotona dauurica* (Pallas)**

Lepus dauuricus PALLAS, 1776, 'Reise,' III, p. 692.

A uniform sandy ochraceous above, paler on the sides, feet white washed with buff above; prominent pale buffy patches behind ears. Below, the hairs are slaty at base, tipped with white; a buffy collar on the throat extends back medially as a wash of the same color to chest.

Superficially this species greatly resembles *O. pallasi* which occurs in the same localities with it in the Gobi Desert but may be recognized at once by its feet, the toe pads of which are completely hidden by short forwardly directed hairs, while in *O. pallasi* the pads are naked and obvious at a glance. In details the present species is slightly paler in color, the ochraceous tints not quite as bright on cheeks, sides and rump, the bright tuft of hair below the ear is lacking, and the upper lip is narrowly white like the chin instead of ochraceous like the rest of the head.

A specimen from Turin, Mongolia, May 11, is still in the full soft coat of winter, a pale and uniform ochraceous buff slightly darkened by the minute black tips of the hairs above. Specimens taken about May 18-20 show the new hair coming in on head and shoulders, a condition also shown by specimens taken as late as June 11.

This species possibly breeds earlier than *O. pallasi*, for very small young (length, 105 mm.) were taken some twenty miles southwest of Urga on May 18 and 19, 1922, and others May 21 near Tze Tzen Wang.

Another, equally small, was caught at Loh, July 7, and is interesting in having a well-developed first digit on the right hind foot, but whether on the other hind foot, is not certain, as it is injured.

A December specimen from Kweihwacheng, Shansi, should probably represent *O. bedfordi* Thomas from Ningwufu and Kolanchow, Shansi, and Yeninfu, Shensi, which is said to differ in its rather larger size and larger bullæ. The measurements given, however, are not greater than those shown by specimens of *O. dauurica* from localities in northern Mongolia. Indeed, some of the latter have even larger bullæ. The Kweihwacheng specimen, though not full grown, appears identical in measurements with Mongolian examples. In its full winter coat, it is a uniform pale sandy buff, with paler post-auricular patches; below white, with a buffy collar which is prolonged as a narrow median buffy line along the ventral region.

***Ochotona pallasii* (Gray)**

Lagomys pallasii GRAY, 1867, Ann. Mag. Nat. Hist., (3) XX, p. 220.

A large sandy-buff (summer) species, with gray belly washed with buff. In the skull the incisive and palatal vacuities are separate.

A series of some fifty specimens was secured in 1922, from localities in the Gobi Desert, Mongolia: Gun Burte, Ussuk, Artsa Bogdo, and 40 miles southwest of Tze Tzen Wang. An adult from the last locality was still in very-worn winter pelage on June 1, of a nearly uniform sandy gray above; the feet above and a tuft at the anterior base of the ear pale buffy; rump slightly more ochraceous; throat and middle of belly pale ochraceous. A second adult from the same locality, May 31, is similar but small patches of the ochraceous summer pelage are coming in on nose, base of ears, patch below ears and in the middle of back. Others from Gun Burte, June 21, have new ochraceous hair on nose, forehead, cheeks and a "whisker" patch of upwardly directed hairs below the ear, and still others taken at the same time and place are slightly farther advanced, the new pelage extending from nose to shoulders, and across the posterior part of the back. In somewhat younger (and more vigorous) animals, also taken June 21, the change is complete, the entire dorsal surfaces sandy, with a bright ochraceous tone, clearest on head, neck and rump, the feet paler; belly hairs slaty with whitish tips and a wash of ochraceous across the throat and medially on the belly. About a centimeter below the ear is a small patch of close, upwardly directed hairs, of contrastingly rufous color.

Several small young were taken as early as May 31 and June 1, forty miles southwest of Tze Tzen Wang, and others of about the same size June 21 at Gun Burte, June 25 at Ussuk, and July 11-24 at Artsa Bogdo.

A ready means of distinguishing this from *O. dauurica* is through the naked black pads, clearly visible at the ends of the toes in the present species; also, the hind claws are shorter.

***Ochotona cansa morosa* Thomas**

Ochotona cansa morosa THOMAS, 1912, Ann. Mag. Nat. Hist., (8) X, p. 403.

A dark brown race, having a plentiful admixture of black with ochraceous-tipped hairs. Feet with dark metapodial areas and pale buffy digits. Below, the hairs are white-tipped, the median area, or all but a lateral stripe, washed with ochraceous. The blue-gray bases of the hairs everywhere show through. Soles of hind feet dark brown.

Five skins from Tai Pai Shan, Tsing-ling Mts., at 10,000 feet, are nearly topotypes of this subspecies. From the same region Thomas has described a similar but grayer and white-bellied species, *O. syrinx*, which, however, was not met with by the Asiatic Expeditions.

***Ochotona forresti* Thomas**

Ochotona forresti THOMAS, 1923, Ann. Mag. Nat. Hist., (9) XI, p. 662.

A dark brown species allied to *O. tibetana* but larger and more ochraceous in color.

The type, from 13,000 feet, on the northwest flank of the Lichiang range, Yunnan, is described as larger than any other known member of the *tibetana* group (length 185 mm.). The collection contains a single immature female from 12,000 feet on the same range.

***Caprolagus sinensis sinensis* (Gray)**

Lepus sinensis GRAY, 1833-34, 'Illustrations of Indian Zool.,' II, Pl. xx.

This is the common rabbit of South China, of a bright ochraceous buff, much darkened above by long black hairs, and having a blackish patch on the face below the eye; chin and throat buff, mid-ventral area white.

So different is this rabbit in its external and cranial characters from the more typical members of the genus *Lepus*, that it can no longer be regarded as congeneric with them. In its short ears, short hind foot, short, nearly concolorous tail, and relatively harsh pelage it is obviously

peculiar, and the characters of the skull further emphasize its distinctness. In all these points it shows much agreement with *Caprolagus hispidus* of Nepal and Assam, and I am therefore transferring it to that genus. As in *Caprolagus*, the supraorbital processes are less developed than in *Lepus*, lack the deep notch anteriorly, and their tips do not extend back to the braincase. The postorbital constriction is narrower as well, so that when viewed from above much more of the orbit is visible, whereas in *Lepus*, the large supraorbital process overhangs and hides the greater part of the orbit. In two out of five specimens the sutures of the interparietal bone are distinct all around, but in the others its posterior outlines are obliterated. The bone itself is very narrow. The jugal bone, instead of having its edges raised to form a wide external gutter as in *Lepus*, is flat on its outer surface, with the usual deep excavation near the anterior end. Other obvious differences are the generally heavier nature of the bones of the skull, the narrower opening of the posterior nares, and the smaller bullæ. The teeth agree with those of *Caprolagus* in the heavier form of the incisors with their simple groove (in the upper anterior pair) which, however, is deeper and more filled with cement in *C. hispidus* than in *C. sinensis*. The first upper premolar has three deep subequal re-entrant folds of enamel on its anterior face, whereas in *Lepus* the middle loop is deepest, the two others shallower. In *C. hispidus* the incisive foramina appear to be shorter and narrower than in *C. sinensis*, with the palatal bridge relatively longer, but these differences may be regarded as specific rather than generic.

The name *Lepus sinensis* first appeared on Gray's colored plate, said to have been drawn from a specimen sent by Reeves to the British Museum. As noted by Thomas in another connection, Reeves' mammals came from southeastern China, "more or less in the region of Canton," which may therefore be regarded as the type locality. It ranges northward along the coast apparently at least to the vicinity of Shanghai. The specimens secured by the Asiatic Expeditions are from Futsing and Yenping in Fukien Province, and Tung-lu, Chekiang. In the mountains of northwestern Fukien it is represented by the following subspecies.

***Caprolagus sinensis flaviventris*, new subspecies**

TYPE.—Sub-adult female, skin and skull, No. 84500, American Museum of Natural History, from Chunganhsien, Fukien Province, China. August 1, 1926. Clifford H. Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Like the typical form but darker, the ochraceous tints deeper and the entire underparts ochraceous buff instead of being pure white mid-ventrally.

General color above a mixture of ochraceous buff and black. The longer hairs are of two kinds: those having a dark blackish base then a broad ochraceous band and a fine black tip; while mixed with these are hairs entirely black, which predominate over the back and rump, and become less numerous on the sides. Head, proœtote and tail above, dark mixed black and ochraceous like the back; sides of the head, especially below the eyes, black, only slightly mixed with ochraceous; an ill-defined pale buffy eye-ring. Neck patch clear ochraceous rufous. Outer margin of ears buff, their metentote and metectote more ochraceous. Fore feet and limbs above ochraceous rufous. Hind feet and entire underparts from chin to lower side of tail clear ochraceous, the bases of the belly hairs gray. A few black hairs are present on the lower throat.

SKULL.—Apparently this is not different from that of the typical race.

MEASUREMENTS.—In the type, the ear from meatus measures 62 mm., the hind foot 88, the tail 55. In a larger, male specimen the hind foot is 98 mm., the ear about 60. The skull of the type measures as follows (with the corresponding measurements of a larger, more mature female of *C. s. sinensis* from Tunglu, Chekiang, No. 45338, in parentheses): greatest length, 77 (84) mm.; basal length, 60.5 (65.5); palatal length, 30 (33); incisive foramina, 18.5 (19.5); nasals, median length, 26 (27); zygomatic width, 37 (37.5); interorbital width, 17 (17); postorbital constriction, 11.5 (11); width of brain-case, 24.5 (26.5); interpterygoid width, 6.8 (6.8); length of bulla from ventral aspect, 9.5 (10); diastema, 19 (20); upper cheek teeth, 14.5 (15.6); lower cheek teeth, 15.5 (16).

Five specimens, including two very young ones, from Chunganhsien, near the northwest border of Fukien Province, all agree in the uniform ochraceous coloring of the under side, instead of being pure white mid-ventrally from the chest to vent. Mr. Clifford H. Pope who secured this series writes that the altitude here is 4000 to 5000 feet: "the mountains are forested and wild and probably reach an altitude of 7000 feet."

A narrow white mark is present on the forehead of the young and some of the adults.

***Lepus tolai tolai* Pallas**

Lepus tolai PALLAS, 1778, 'Nov. Spec. Quad. e Glirium Ord.,' p. 17.

The nomenclature of the black-tailed hares of central and eastern Asia is still much in need of revision. The first applicable name is that of Pallas who in 1778 described *Lepus tolai* which lives "in deserto magno Gobiensi ubique ad Tybetum usque." In 1894 Thomas described *L. swinhoei* from Chefoo, Shantung Province, China, and other names have since been given to similar hares from that country, though seemingly the differences are slight. In 1907 Satunin gave new names to various Asiatic hares on the basis of small color characters, and with few comparative notes. In this group, the ear from crown is slightly shorter than the hind foot (with claw), there is a pale eye stripe and ring, the

tail is black above and pure white below to the roots, and the sides of the body in the winter pelage have a number of very long white-tipped bristles projecting far beyond the general surface of the pelage. Of the 58 specimens of this type collected by the Asiatic Expeditions of The American Museum of Natural History, as well as in a series in the Museum of Comparative Zoölogy, those from the Gobi Desert are practically all in their summer coat while those from China are in full winter pelage so that strictly comparable specimens are few. It is evident, however, that the hare of the Gobi Desert is paler in winter coat than that of North China, with more prominent gray rump, though within narrow limits there is considerable variation. Satunin regarded specimens from Transbaikalia as typical of *L. tolai* and describes the Gobi Desert hare as a distinct species, *L. gobicus*, but the differences noted are very slight, and it seems unlikely that the hares from Selenga River (which he assumes as the type locality of *L. tolai*) are very different from those inhabiting the northern Gobi, even if it were possible to ignore Pallas's statement that the Gobi Desert is the type region. For the present then, the pale, gray-rumped hare of the Gobi Desert may be considered as *L. tolai*, of which *L. gobicus* is a synonym. The species is represented in the collections of the Asiatic Expeditions by specimens from thirty miles south of Ude, thirty miles south of Urga, from Erhlien, Tsagan Nor, Ussuk, Artsa Bogdo, and Ula Usu, Mongolia.

***Lepus tolai swinhoei* Thomas**

Lepus swinhoei THOMAS, 1894, Ann. Mag. Nat. Hist., (6) XIII, p. 364.

A brighter colored, more buffy race, with slightly longer nasals than typical *L. tolai*.

More than thirty years ago Thomas pointed out the characters distinguishing the Chefoo Hare from the grayer form of the Gobi Desert, but although the two have since been regarded as distinct species, there seems now no doubt of their closer relationship, and I have therefore regarded the former as a subspecies of the latter. In winter pelage Swinhoe's Hare is mixed buffy and black above, with a number of long white-tipped hairs projecting beyond the rest of the pelage on the sides. The summer coat is shorter and lacks these longer hairs.

A number of specimens from the Peking region secured by the Asiatic Expeditions represent this race. Others from Shansi are obviously less yellow in winter pelage with a very pinkish tint, while a few from the Ichang region in the Yangtze Valley are richer in tone becoming almost rusty. Since names are available for these geographic variants, they are

recognized as below. Typical *swinhoei* was described from the Shantung peninsula, and the Peking specimens are assumed to be the same. In winter coat they are pale yellowish above, but some are hardly distinguishable from the next race. A large proportion (six of 13 skins) show more or less mixture of buffy-tipped hairs with the black of the tail, a character used by Matschie as the basis of his *Lepus stegmanni*, shown by Thomas to be a synonym of *L. swinhoei*.

***Lepus tolai filchneri* Matschie**

Lepus filchneri MATSCHIE, 1908, 'Exped. Filchner nach China und Tibet,' X, pt. 1, pp. 217-219.

Lepus swinhoei brevinasus J. A. ALLEN, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 427.

Lepus swinhoei sowerbyæ HOLLISTER, 1912, Proc. Biol. Soc. Washington, XXV, p. 182.

The series of black-tailed hares collected by the Asiatic Expeditions includes ten from Kweihwacheng, northern Shansi, in freshly assumed winter coat (October 22-24), and four (one in winter coat) from the Tai Pei Shan region of southern Shensi. All are quite similar in color and undoubtedly represent *L. filchneri* described by Matschie from Hingan-fu, southern Shensi, with the description of which they quite agree. They show an average difference in coloring that separates them from the grayer form of the Gobi Desert, true *tolai*, but their similarity to the Chefoo Hare, *L. t. swinhoei*, is rather closer. They may usually be distinguished, however, by the decidedly pinker, less yellowish, tint of the back and sides, and by the buffier tint of the back and exposed inner portion of the ear including its fringe of longer hairs at the outer edge, portions which in *swinhoei*, as represented by specimens from Peking, tend to be white or whitish, even forming a contrasting white edge above and below. In addition there is less tendency to a mixture of buffy hairs with the black of the tail, and the nasal bones of the skull average slightly shorter. A winter specimen from Tai Pei Shan is quite the same as the Kweihwacheng series. Three others from near Sianfu, Shensi, are in summer pelage which is much shorter, and uniformly pale yellowish (buff) grizzled with black above, clear buff on the sides and limbs, and without the long whitish bristles of the winter coat. There is no doubt that Hollister's *Lepus swinhoei sowerbyæ* (1912) from northern Shansi is the same. He compared it with the pale race *subluteus* of the Ordos Desert and described it as having a grayer rump, lighter pinkish-buff chest-band and more white on the under side of the fore legs, char-

acters which prove to be rather variable when a series is examined. It is possible that *Lepus gansuicus* Satunin (1907) from Kansu may prove indistinguishable, in which case this name has precedence.

***Lepus tolai aurigineus* Hollister**

Lepus aurigineus HOLLISTER, 1912, Proc. Biol. Soc. Washington, XXV, p. 181.

In the southern part of its range in China the black-tailed hare responds to the warmer and moister climate by a marked increase in the brightness of its yellowish tints. In winter pelage the entire upper parts are bright ochraceous much mixed with black; the spot before the eye, the eye-ring, inside of ears and their borders are rich ochraceous, the fore legs and chest-band pale cinnamon, the sides clear buff. Hollister's *Lepus aurigineus* is evidently this form, which may now be considered a race of *L. tolai*. The type locality is Kiu Kiang, northern Kiang-si.

Through the kindness of Mr. G. S. Miller, Jr., U. S. National Museum, I have been able to compare the type with other Chinese specimens, and it is unquestionably a member of the *tolai* group. Though nearly full-grown it is nevertheless immature as indicated by the skull, while the skin itself has the appearance of having been prepared from an alcoholic specimen. It lacks the tail and is obviously somewhat faded.

A series of winter skins, collected by the late W. R. Zappey in western Hupeh Province for the Museum of Comparative Zoölogy, is referred to this race while two others from Wanh sien on the eastern border of Szechwan, secured by the Third Asiatic Expedition of The American Museum of Natural History, are nearly similar, though one is less ochraceous than the other. Probably these two are best regarded as intergrades between the two subspecies, *filchneri* and *aurigineus*.

***Lepus comus*, new species**

TYPE.—Adult female, skin and skull, No. 43174, American Museum of Natural History, from Teng-yueh, Yunnan Province, China, 5,500 feet altitude. April 19, 1917. R. C. Andrews and E. Heller.

DESCRIPTION.—Related to *L. nigricollis* but with longer hind foot, color darker, less buffy, the nape dull brown, the tail beneath and bases of belly-hairs pale slaty gray.

Head, above, dull ochraceous buff, slightly mixed with black; a whitish band from the muzzle to the base of the ear, including both eye-lids; cheeks grizzled buffy, gray, and black. Nape patch dull russet with many pale-tipped hairs. Ears dark, the proëctote grizzled buffy and black, the anterior edge with a fringe of longer grayish hairs on its basal three-fourths, the posterior edge clearer white; tip of ear, both its edge and posterior terminal half of metectote, dark brown; base of metectote sparsely covered with short grayish hairs. Inside of ears with very few pale hairs, but an ill-

defined dark brown submarginal border basally. The back is a very dark mixture of buffy and blackish in about equal proportions. The individual hairs are about 32 mm. long, grayish at base, then ringed with ochraceous, then with black, succeeded by a buffy tip. On the rump these rings become very much paler and the tips whitish, resulting in a grizzled gray appearance. The flanks, fore legs from elbow, and outer side of hind legs and backs of hind feet are clear ochraceous buff. The tail is peculiar in being grizzled blackish-brown and whitish above like the rump, and gray faintly tinged with buffy below, the basal portion of all the hairs pale slaty gray instead of pure white. The throat band is clear ochraceous with a sprinkling of longer white-tipped hairs. Chin, inner sides of legs to elbow and heel white; the chest and belly white with blue-gray bases except anteriorly where the hairs are pure white throughout their length.

SKULL.—In general structure the skull is very different from that of the black-necked hares of the *L. tolai* group, but closely resembles that of *L. nigricollis*. In the former the anterior edge of the orbit forms a slight wing standing out at right angles to the long axis of the skull, but in the latter the sides of the rostrum come straight back to this edge so that there is little if any projecting rim and the base of the rostrum appears much broader in proportion. The supra orbital processes are more slender with their anterior arm marked off by a short narrow slit in *L. nigricollis* and *L. comus* but in the *tolai* group are widely notched in front, and in addition are turned slightly upward, so that in profile they stand up above the general contour of the skull. In *L. comus* and *L. nigricollis* the profile is evenly convex whereas in *L. tolai* the nasals are less depressed and the dorsal outline of the braincase is more sharply bent downward. The meatus of the ear is also directed more posteriorly in the two first. In ventral view the inner margin of the bulla is broader and its foramen more prominent. The groove on the front face of the incisors is continued backward with two short lateral arms, forming a Y. The portion internal to this groove projects forward beyond the level of the outer part of the tooth.

MEASUREMENTS.—The type measured: length, 480 mm.; tail, 95; hind foot with claws, 130; ear, 97. The skull of the type and an imperfect one of a second specimen from the same locality measure: greatest length, 95, —; basal length, 76, —; palatal length, 39.5, 37; diastema, 27.5, 25; nasals, greatest length, 41, 41; length of contact medially, 31, 31; greatest width, 24, 23.5; zygomatic width, 42.5, —; mastoid width, 30, —; width outside molars, 26, 26.5; outside lacrymals, 35.5, 32 +; upper cheek teeth, 17.6, 17.4; lower cheek teeth, 18.2, 17.5; jaw, condyle to tip of bone at base of incisors, 70.5, 67.5.

The discovery of this hare is a matter of great interest, since it is closely allied by the characters of the skull to *L. nigricollis*, the black-necked hare of the Indian peninsula and Ceylon (subspecies *singhala*), but differs strikingly in color, especially in the dark back with its lack of bright buffy and the dull russet instead of black nape, the gray bases of the white hairs of the belly, and particularly in the tail which is pale slaty gray underneath. In its large size, notably of the hind foot, it differs further from *L. nigricollis*. The species *L. siamensis* and *L. peguensis* are much smaller and probably are more nearly related to *L. hainanus*. The skull of the type is peculiar in lacking all trace of the

small second upper incisors but they are present in a second specimen from the type locality. This latter and a young one taken May 10, and an imperfect skin from Lichiang, 8200 feet, agree in all essentials of coloring. A note by the collector states that the type contained two large embryos. Apparently these are the first hares to be recorded from western Yunnan although Wroughton (Journ. Bombay Nat. Hist. Soc., 1915, XXIII, p. 477) mentions that Major Harington secured some hares "beyond Bhamo," eastern Burma, which were "certainly not" *L. peguensis*, and may have been the species here described.

***Lepus hainanus* Swinhoe**

Lepus hainanus SWINHOE, 1870, Proc. Zool. Soc. London, pp. 233, 639, Pl. XVIII, text-figs. 1-4.

A small hare with relatively short stiff pelage and dark coloring, a mixture of dull ochraceous and black above; a prominent white eye-ring, continued to muzzle; fore legs and throat-band bright ochraceous rufous, hind legs paler; chin, belly and under side of tail pure white to the roots. Foot about 85 mm., ear 75.

A series of these hares from Nodoa, Hainan, includes a number of partly grown young taken from January to July. Compared with the hares of North China and Mongolia this differs in several minor points, such as the narrowness of the posterior narial opening, the small size of the bullæ, and the peculiar form of the groove on the front face of the upper incisors. This last, instead of being a simple V-shaped groove with its apex posteriorly, is Y-shaped with the two diverging arms extending as re-entrants posteriorly; the whole filled with cement.

Article III.—THE REPTILES OF HAINAN¹BY KARL PATTERSON SCHMIDT²

With Abstracts from the Field Notes of Clifford H. Pope

PLATE XXVII, TEXT FIGURES 1 TO 17

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INTRODUCTION

The Island of Hainan occupies a position of especial interest for the student of the Chinese fauna. Lying almost wholly south of latitude 20° N., it is the southernmost extension of the Chinese Empire. In the same latitude as northern Indo-China and northern Luzon, its faunal relations are primarily Oriental and its fauna is more purely tropical in character than that of any other corner of China. In spite of its rather narrow separation from the mainland, its herpetological fauna contains a considerable number of endemic forms, though their number may be reduced in the future by discoveries in southern China and Indo-China. A number of forms first described from Hainan have since been recorded from the mainland, and the present studies, on the whole, serve to reduce the proportion of forms confined to the island.

The collection of amphibians and reptiles made by Mr. Clifford H. Pope for the Third Asiatic Expedition of The American Museum of Natural History, during his stay in Hainan from December 1922 to July 1923, is by far the most extensive in number of both specimens and species that has yet come from this island. Of no less importance is the excellence of the preservation of his specimens. Mr. Pope has given an interesting account of his work in Hainan in 'Natural History' (Pope, 1924).

¹Publications of the Asiatic Expedition of The American Museum of Natural History. Contribution No. 75.

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The present paper concerns only the reptiles¹ of Mr. Pope's collection, of which there are fifteen hundred and eighty specimens, representing forty-nine species. Listed according to the families represented, these specimens and species are distributed as follows:

| | NUMBER OF GENERA | NUMBER OF SPECIES | NUMBER OF SPECIMENS |
|---------------------------------|---------------------|----------------------|------------------------|
| TURTLES | | | |
| Platysternidæ | 1 | 1 | 17 |
| Testudinidæ | 4 | 5 | 77 |
| Trionychidæ | 2 | 3 | 7 |
| LIZARDS | | | |
| Gekkonidæ | 2 | 2 | 154 |
| Agamidæ | 4 | 4 | 398 |
| Varanidæ | 1 | 1 | 5 |
| Lacertidæ | 1 | 1 | 214 |
| Scincidæ | 5 | 5 | 101 |
| SNAKES | | | |
| Typhlopidae | 1 | 1 | 37 |
| Pythonidæ | 1 | 1 | 7 |
| Colubridæ (<i>sens. lat.</i>) | 16 | 24 | 528 |
| Crotalidæ | 1 | 1 | 41 |

Five species, two lizards and three snakes, appear to be new:²

Sphenomorphus leveretti

Lygosaurus salsburyi

Sibynophis hainanensis

Natrix popei

Natrix andrewsi

Eleven more, five turtles, one lizard and five snakes, are additions to the fauna of Hainan:

Turtles

Platysternon megacephalum

Clemmys bealii

Cyclemys trifasciata

Pyxidea mouhotii

Pelochelys cantorii

Lizards

Eumeces quadrilineatus

Snakes

Elaphe taniura vaillanti

¹A paper on the Amphibians of Hainan is in course of preparation by Dr. G. K. Noble and Clifford H. Pope.

²Advance diagnoses of the new forms were published in American Museum Novitates, No. 157, pp. 1-5, February 13, 1925. If Werner, 1924, antedates this, it will be necessary to place *Natrix andrewsi* in the synonymy of *Natrix ornaticeps* (Werner). This paper, however, was not received in the United States until about April, 1925, and Werner (1926) merely states that his paper has priority (which is, of course, probable), without mention of the date of publication.

Elaphe porphyracea
Ahaetulla boiga
*Bungarus multicinctus*¹
Calliophis maclellandii

While the entire collection was made with Nodda as a base, the actual localities of collection lie within a considerable radius of Nodda, most of the specimens having been brought in by native boys or hunters. Specimens collected in the mountainous area south of Nodda have been so distinguished in the following account of the species.

In the course of studies for the present report, I have been indebted for advice especially to Dr. Leonhard Stejneger, whose contributions to Oriental herpetology make him the chief authority in this field. Many points have been discussed with Mr. Pope, whose first-hand knowledge has thus supplemented my laboratory acquaintance with the specimens. For access to the collections in their care and for friendly aid while studying those collections, I am indebted to Dr. Stejneger and Miss Doris Cochran at the United States National Museum, to Dr. G. K. Noble and Mr. Pope at The American Museum of Natural History, and to Dr. Thomas Barbour and Mr. Arthur Loveridge at the Museum of Comparative Zoölogy at Harvard University.

For the opportunity to report on the results of the work of the Third Asiatic Expedition, I am indebted to Mr. Roy Chapman Andrews, and the arrangement has been made possible by a cordial coöperative agreement between The American Museum of Natural History and the Field Museum of Natural History.

SUMMARY OF PREVIOUS CONTRIBUTIONS TO THE HERPETOLOGY OF HAINAN

Our knowledge of the reptiles of Hainan begins with the list published by Swinhoe in 1870, in which he enumerates nine species, identified by Günther, with some observations of his own upon them. These are:

| | |
|--------------------------|------------------------------|
| <i>Varanus dracaena</i> | <i>Calotes versicolor</i> |
| <i>Mabouia chinensis</i> | <i>Liolepis guttatus</i> |
| <i>Peripia peronii</i> | <i>Simotes species</i> |
| <i>Draco species</i> | <i>Tropidonotus stolatus</i> |
| <i>Python molurus</i> | |

Six of these species reappear in Boulenger's catalogues of specimens in the British Museum. *Mabouia chinensis* is apparently referred to *M. siamensis*; *Peripia peronii* to *Hemidactylus frenatus*; *Simotes* sp. to

¹Recorded by Boulenger from the Neumann collection.

Simotes violaceus; and *Tropidonotus stolatus* appears without change. The *Draco* sp. reappeared in the Whitehead collection as *Draco whiteheadi* Boulenger. Singularly enough, the *Varanus* was omitted from all subsequent lists, to reappear in the present collection, together with *Peropus mutilatus* (= *Peripia peronii*).

Bættger in 1888 records a collection made in Hainan by Otto Herz. He lists the following sixteen species, of which thirteen are additions to the known reptile fauna:

| | |
|-----------------------------------|--------------------------------|
| <i>Calotes versicolor</i> | <i>Hypsirhina bennetti</i> |
| <i>Liolepis belli</i> | <i>Hypsirhina chinensis</i> |
| <i>Eumeces chinensis</i> | <i>Hypsirhina plumbea</i> |
| <i>Typhlops braminus</i> | <i>Naja tripudians</i> |
| <i>Ptyas korros</i> | <i>Hydrophis cyanocinctus</i> |
| <i>Ptyas mucosus</i> | <i>Hydrophis gracilis</i> |
| <i>Tropidonotus quincunciatus</i> | <i>Hydrophis viperinus</i> |
| <i>Tropidonotus stolatus</i> | <i>Trimeresurus erythrurus</i> |

In 1894 Bættger makes three additions to this list from the collection of Bernhard Schmacker. These are:

Clemmys schmackeri, new species
Mabuia multifasciata
Simotes hainanensis, new species

In the 'Catalogue of Snakes' Boulenger records a collection of snakes received from J. Neumann, supposedly made at Hoi-How, Hainan. The species represented are:

| | |
|--------------------------------|---------------------------------|
| <i>Python molurus</i> | * <i>Simotes chinensis</i> |
| * <i>Tropidonotus tigrinus</i> | <i>Hypsirhina plumbea</i> |
| * <i>Dinodon rufodorsatum</i> | <i>Hypsirhina chinensis</i> |
| <i>Zamenis korros</i> | * <i>Bungarus candidus</i> |
| * <i>Zamenis spinalis</i> | <i>Naja tripudians</i> |
| * <i>Coluber rufodorsatus</i> | * <i>Ancistrodon blomhoffii</i> |
| * <i>Coluber dione</i> | |

Eight of these thirteen species (marked * above) are new to the Hainan list; and, of these, six are North Chinese forms, which were scarcely to be expected in Hainan. Stejneger (1907, p. 318) suggests that these records require confirmation. Mell (1922, p. 104) states that Neumann also collected in northern China and he omits these species from his faunal list for Kwangtung and Hainan, as of erroneous record. Finally, not one of these six species occurs in the present extensive collection and, in view of this fact, I prefer to disregard the entire list. This deletes in addition to the northern species, only *Holarchus chinensis* from the Hainan list, *Bungarus multicinctus* reappearing in the present collection.

Cope recorded a small collection of seven species from Hainan in 1895. His additions to the fauna are the singular water-snake, *Trimerydytes balteatus*, and *Amblycephalus moellendorffii*. His *Holarchus dolleyanus* appears to be a synonym of *H. violaceus*.

The next important contribution to the fauna is Boulenger's report on the collection made by Mr. John Whitehead in the interior of Hainan, on the expedition which cost him his life. The reptiles recorded are:

**Draco whiteheadi*

Calotes versicolor

**Acanthosaura hainanensis*

Tropidonotus chrysargus

Two of these (marked *) are new species, and *Tropidonotus chrysargus* is a further addition to the fauna.

In 1906 Siebenrock described *Amyda steindachneri*, from Hainan and Indo-China, and added records of *Ocadia sinensis* and *Amyda sinensis* to the Hainan list. A single species of turtle (*Clemmys schmackeri*) was previously known from Hainan.

Barbour, in 1908 and 1909, records a number of specimens secured from the Owston collection, of which four are new to Hainan and three are new species. His additions are:

Goniurosaurus hainanensis

Holarchus nesiotes

Natrix equifasciata

Boiga multimaculata

Following the nomenclature of Stejneger's important 'Herpetology of Japan' (which contains some valuable remarks on the Hainan fauna), Barbour's paper introduces some of the Hainan species under the names now in use. In 1912 Barbour added *Psammodynastes pulverulentus* to the Hainan list, and discussed several of the Hainan species.

Vogt, in 1913, records a collection of fourteen species from Hainan, collected by Herr Schoede and presented to the Berlin Museum. Vogt concludes his paper with a list of the reptiles known from Hainan, enumerating four turtles, nine lizards, and twenty-five snakes. This list omits, *Peropus mutilatus*, *Varanus salvator*, *Natrix chrysarga*, *Boiga multimaculata*, and *Disteira gracilis* and *viperina*. With these omissions, the omission of the entire Neumann list, and the additions above noted, the total species of reptiles known from Hainan in 1913 would be four turtles, eleven lizards, and twenty-one snakes, a total of thirty-six species.

Stanley (1914) records a few specimens from Hainan in the Shanghai Museum.

Mell and Vogt in 1922 gave a nominal list of the forms recorded from Hainan, and their notes on the Kwangtung fauna are of especial importance to the study of that of Hainan.

Dr. Malcolm A. Smith's 'Journey to the Interior of Hainan' (Smith, 1923), undertaken in 1923 during Mr. Pope's stay at Nodoo, resulted in the collection of thirty species of reptiles, the most extensive collection from Hainan thus far recorded. It is reported upon in two highly interesting papers, a narrative of the trip, and a report on the collection (Smith, 1923a). Four species of reptiles, two lizards and two snakes, are described as new, and seven more are additions to the known fauna.¹ These eleven² forms are the following:

| | |
|---|-------------------------------|
| <i>Takydromus sexlineatus</i> | <i>Leiopisma laterale</i> |
| * <i>Gekko similignum</i> | <i>Natrix percarinata</i> |
| <i>Hemidactylus garnoti</i> | <i>Pseudozenodon melli</i> |
| * <i>Tropidophorus hainanus</i> | <i>Lycodon subcinctus</i> |
| <i>Sphenomorphus indicus</i> | * <i>Achalinus meridianus</i> |
| * <i>Amblycephalus carinatus hainanus</i> | |

The new species are marked with an asterisk.

Clifford H. Pope (1924, p. 218) records having seen the skin of a very large cobra, presumably a king cobra, at Nodoo. While this form is certainly to be expected in Hainan, I have omitted it from the final list pending the examination of a specimen.

ANNOTATED LIST OF THE SPECIES COLLECTED

TESTUDINATA

Platysternidæ

Platysternon megacephalum Gray

Figure 1

Platysternon megacephalum GRAY, 1831, Proc. Zoöl. Soc. London, p. 107.

Platysternum megacephalum BOULENGER, 1889, 'Cat. Chelon, Brit. Mus.,' p. 46, figs. 13-14. SIEBENROCK, 1907, Sitzber. Akad. Wiss. Wien (math.-natur.), CXVI, Abt. I, p. 1742, fig. 2; 1909, Zool. Jahrb., Suppl., X, p. 450.

Seventeen specimens, A. M. N. H. Nos. 30108-30124, were collected by Mr. Pope in Hainan, all, apparently, being from the mountains some distance to the south. They form the first record of this species from Hainan.

The specimens form a series from a carapace length of 88 mm., with a sharply defined ventral marking, to one of 184 mm., without a trace of the ventral pattern, and with effaced growth-rings. The smallest specimen has only one growth-ring on its horny shields. I do not find any sex

¹Dr. Smith's changes in the nomenclature of the sea-snakes, in his fine monograph of this group (1926), are incorporated in the list at the end of this paper.

²*Hoigia multimaculata* and *Amblycephalus moellendorffi* are included in the list of additions by Smith.

differences in measurements in this series, beyond the usual concavity of the plastron in males.

The measurements¹ of the shells of ten specimens are shown below, with the average for sixteen.

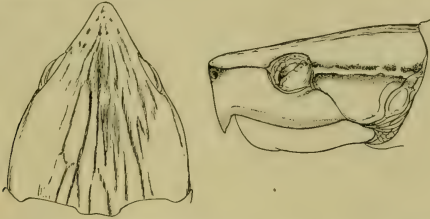


Fig. 1. *Platysternon megacephalum*, A. M. N. H. No. 30109.
Head from above and from side, life size.

| A. M. N. H. No. | LENGTH CARAPACE | BREADTH CARAPACE | GREATEST DEPTH | LENGTH PLASTRON | LENGTH TAIL |
|----------------------------|--------------------|---------------------|-------------------|--------------------|----------------|
| 30108 | 85 mm. | 71 mm. | 26 mm. | 64 mm. | 90 mm. |
| 30109 | 98 | 81 | 31 | 76 | 104 |
| 30112 | 110 | 85 | 37 | 85 | 121 |
| 30113 | 115 | 90 | 36 | 93 | 123 |
| 30115 | 134 | 105 | 45 | 101 | 153 |
| 30117 | 148 | 100 | 43 | 118 | 158 |
| 30118 | 153 | 114 | 49 | 125 | 183 |
| 30122 | 166 | 114 | 50 | 125 | 182 |
| 30123 | 176 | 125 | 56 | 140 | 198 |
| 30124 | 184 | 129 | 62 | 139 | .. |
| Average of 16 specimens | 136 | 101 | 43 | 107 | 146 |

"All of the specimens of this species were brought out of the mountains by a Loi.

"These turtles walk with their bodies slightly raised from the ground, with their tails dragging. Two specimens were timed and made respectively 25 and 27 feet per minute on level ground covered with short grass. When at rest, they usually draw the tail up close to one side. They bite when teased, but tend to hold on rather than to snap. When tapped on one side of the shell they raise the opposite side, apparently leaning toward the annoying object, like a toad (or like a snapping turtle)." (C.H.P.)

¹In this, as in subsequent species, the length of carapace and plastron is on the median line; the breadth is the greatest breadth, and the depth the greatest vertical depth of the shell, all measurements being taken with calipers. The length of the tail is from the middle of the posterior border of the plastron

Testudinidæ

Ocadia sinensis (Gray)

Figure 2

Emys sinensis GRAY, 1834, Proc. Zool. Soc. London, p. 53.

Ocadia sinensis GRAY, 1870, 'Suppl. Cat. Shield Rept. Brit. Mus.,' I, p. 35. BOULENGER, 1889, 'Cat. Chelon. Brit. Mus.,' p. 85. SIEBENROCK, 1903, Sitzber. Akad. Wiss. Wien (math.-natur.), CXII, Abt. 1, p. 334; 1906, Zool. Anz., XXX, p. 578. STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 489, Pl. XXVIII, text figs. 377-381. SIEBENROCK, 1909, Zool. Jahrb., Suppl., X, p. 470. SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 197.

Twenty-four specimens of this species, A. M. N. H. Nos. 30173-30196, are in the collection. This series offers no discrepancies from the excellent descriptions of Stejneger and Siebenrock.

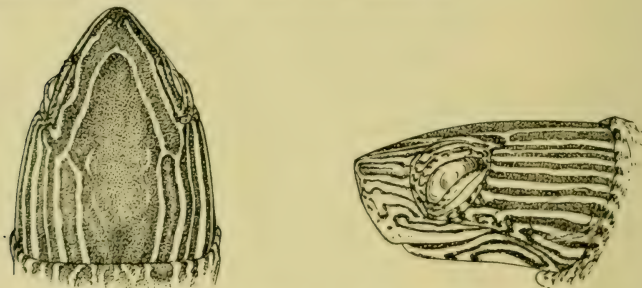


Fig. 2. *Ocadia sinensis*, A. M. N. H. No. 30184.

Head from above and from side, life size.

The measurements of ten specimens of this species are as follows:

| A. M. N. H. No. | SEX | LENGTH CARAPACE | BREADTH CARAPACE | DEPTH | LENGTH PLASTRON | TAIL LENGTH |
|----------------------------|------|--------------------|---------------------|--------|--------------------|----------------|
| 30173 | juv. | 58 mm. | 50 mm. | 25 mm. | 49 mm. | 33 mm. |
| 30176 | juv. | 80 | 64 | 37 | 67 | 40 |
| 30177 | juv. | 89 | 70 | 37 | 75 | 43 |
| 30179 | ♀ | 101 | 79 | 45 | 87 | 43 |
| 30184 | ♂ | 110 | 82 | 43 | 94 | 52 |
| 30189 | ♀ | 122 | 92 | 53 | 106 | 53 |
| 30191 | ♀ | 133 | 94 | 52 | 110 | 54 |
| 30194 | ♀ | 149 | 107 | 61 | 127 | 52 |
| 30195 | ♀ | 196 | 140 | 79 | 174 | 65 |
| 30196 | ♀ | 217 | 161 | 86 | 192 | 72 |
| Average of 24 specimens | | 117 | 87 | 48 | 100 | 48 |

The uppermost narrow line in the head-pattern may be absent in large specimens of this species.

***Clemmys bealii* (Gray)**

Figure 3

Cistuda bealii GRAY, 1831, 'Syn. Rept.,' p. 71.

Clemmys bealii STRAUCH, 1862, 'Chelon. Stud.,' p. 32. BOULENGER, 1889, 'Cat. Chelon. Brit. Mus.,' p. 107. SIEBENROCK, 1909, Zool. Jahrb., Suppl., X, p. 482. MELL, 1922, Arch. Naturg., LXXXVIII, Abt. A., Heft 10, p. 109. VOGT, 1922, idem, p. 135.

Clemmys bealii var. *quadriocellata* SIEBENROCK, 1903, Sitzber. Akad. Wiss. Wien (math.-natur.), CXII, Abt. 1, p. 336, Pl. I, figs. 1-2; 1909, Zool. Jahrb., Suppl., X, p. 482.



Fig. 3. *Clemmys bealii*, A. M. N. H. No. 28337.

Head from above and from side, $\times 2$.

Five specimens of this strikingly handsome species, A. M. N. H. Nos. 28337-28341, are in the collection, all brought from the mountains south of Nodoa. This form has not previously been recorded from Hainan.

In the largest specimen the temporal ocellæ are faded to a uniform gray, though still perfectly distinct. These are bright yellow rings surrounding a black spot in the four remaining specimens, and in all five there are two ocellæ on each side.

The measurements of this series are as follows:

| A. M. N. H. No. | SEX | LENGTH CARAPACE | BREADTH CARAPACE | DEPTH | LENGTH PLASTRON | LENGTH TAIL |
|--------------------|-----|--------------------|---------------------|--------|--------------------|----------------|
| 28337 | ♂ | 58 mm. | 59 mm. | 25 mm. | 45 mm. | 28 mm. |
| 28338 | ♂ | 78 | 67 | 31 | 62 | 30 |
| 28341 | ♂ | 121 | 58 | 41 | 100 | 47 |
| 28340 | ♀ | 121 | 89 | 42 | 102 | 41 |
| 28339 | ♀ | 129 | 91 | 46 | 108 | 39 |

The tail is somewhat longer in male than in female specimens, proportionately much longer in the juvenile specimen than in the larger ones. The smallest specimen is also proportionately wider and deeper.

These specimens evidently confirm the surmise of Vogt that *quadriocellata* and *bealii* are identical. The types, redescribed by Boulenger, consisted of a shell and a stuffed specimen, and it is evident that in a dried skin one of the pairs of ocellæ might have become obscure.

***Clemmys mutica* (Cantor)**

Figure 4

Emys mutica CANTOR, 1842, Ann. Mag. Nat. Hist., (1) IX, p. 482.

Damonia mutica BOULENGER, 1889, 'Cat. Chelon, Brit. Mus.,' p. 96.

Clemmys mutica, SIEBENROCK, 1910, Ann. Naturh. Hofmus. Wien, XXIII, p. 312, Pl. XII-XIII.

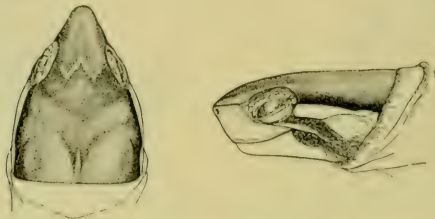


Fig. 4. *Clemmys mutica*, A. M. N. H. No. 30170.

Head from above and from side, life size.

Clemmys schmackeri BETTGER, 1894, Ber. Senck. Ges., p. 129, Pl. III, fig. 1. SIEBENROCK, 1906, Zool. Anz., XXX, p. 378; 1909, Zool. Jahrb., Suppl., X, p. 482. MELL, 1922, Arch. Naturg., LXXXVIII, Abt. A, Heft 10, p. 109.

Nineteen specimens of this species, A. M. N. H. Nos. 30154-30172, are in the collection.

This is a well-marked species, with an invariable head pattern. Siebenrock's reference of *Clemmys schmackeri* to this species seems amply justified, as his excellent figures of a Formosan specimen leave little room for doubt of the identity of the form from Hainan with those described by him.

The measurements of ten specimens are as follows:

| A. M. N. H. No. | SEX | LENGTH CARAPACE | BREADTH CARAPACE | DEPTH | LENGTH PLASTRON | LENGTH TAIL |
|----------------------------|------|--------------------|---------------------|--------|--------------------|----------------|
| 30154 | juv. | 65 mm. | 54 mm. | 32 mm. | 56 mm. | 21 mm. |
| 30157 | juv. | 75 | 61 | 35 | 64 | 27 |
| 30158 | juv. | 93 | 71 | 40 | 79 | 33 |
| 30159 | juv. | 100 | 74 | 43 | 86 | 36 |
| 30160 | juv. | 110 | 83 | 45 | 91 | 45 |
| 30164 | ♀ | 118 | 87 | 48 | 96 | 37 |
| 30166 | ♀ | 132 | 97 | 51 | 109 | 48 |
| 30168 | ♂ | 145 | 106 | 54 | 122 | 47 |
| 30171 | ♀ | 149 | 108 | 58 | 129 | 41 |
| 30172 | ♀ | 154 | 110 | 61 | 127 | 50 |
| Average of 19 specimens | | 114 | 85 | 46 | 96 | 40 |

The fifth vertebral shield, usually nearly equal in size to the fourth, is only half as large in No. 30165. An additional, irregular, fourth vertebral is present in No. 30155. The lateral yellow stripe of the head exhibits minor variations in form. It is usually continuous on the neck, with a straight upper border. A median nuchal stripe, which may be continuous with one at the base of the neck, may be present or absent. There is great variation in the amount of black color on the plastron in this series. No. 30154 (juv.) is uniform black beneath except for the edge of the marginals, the lower angle of the bridge, and a median line, which are yellow. In No. 30162 the plastral shields are black with a broad yellow border on their anterior and median sides. In No. 30168 the yellow color considerably exceeds the black, and black spots are absent from the gular shields.

Deposits of a red pigment (presumably from the water in which the turtles live) frequently obscure the yellow areas of the plastron.

***Cyclemys trifasciata* (Bell)**

Figure 5

Sternotherus trifasciata BELL, 1825, Zoöl. Journ. II, p. 305, Pl. XIII.

Cyclemys trifasciata BOULENGER, 1889, 'Cat. Chelon. Brit. Mus.,' p. 133. SIEBENROCK, 1907, Sitzber. Akad. Wiss. Wien (math-natur.), CXVI, Abt. 1, p. 1763; 1909, Zool. Jahrb., Suppl., X, p. 502. MELL, 1922, Arch. Naturg., LXXXVIII, Abt. A, Heft 10, p. 108.

Twenty-eight specimens of this species, A. M. N. H. Nos. 30126-30153, form the first records of this species from Hainan.

The measurements of a series of ten specimens are as follows:

| A. M. N. H. No. | LENGTH | BREADTH | DEPTH | LENGTH | PLASTRON |
|----------------------------|----------|----------|--------|-----------|------------|
| | CARAPACE | CARAPACE | | ANT. LOBE | POST. LOBE |
| 30127 | 58 mm. | 49 mm. | 25 mm. | 23 mm. | 29 mm. |
| 30131 | 65 | 56 | 24 | 25 | 31 |
| 30132 | 76 | 65 | 26 | 29 | 36 |
| 30135 | 87 | 67 | 34 | 36 | 45 |
| 30137 | 99 | 73 | 40 | 42 | 53 |
| 30140 | 117 | 85 | 43 | 47 | 59 |
| 30149 | 136 | 97 | 49 | 55 | 66 |
| 30150 | 155 | 119 | 59 | 65 | 88 |
| 30152 | 173 | 122 | 65 | 70 | 94 |
| 30153 | 200 | 154 | 87 | 86 | 114 |
| Average of 28 specimens | 110 | 87 | 42 | 45 | 58 |

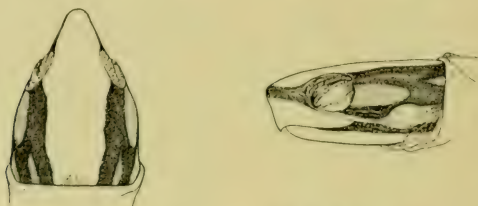


Fig. 5. *Cyclemys trifasciata*, A. M. N. H. No. 30144.

Head from above and from side, life size.

As in other turtles with a hinged shell, the hinge is not developed in the younger specimens. In the present series it is not recognizable in specimens up to about 90 mm. in length, while those over 100 mm. have a well-developed and functional hinge.

The dorsolateral black lines of this species are absent in juvenile specimens and first appear in specimens about 100 mm. long. In the largest specimen there are supplementary black markings which extend from the lateral lines to the marginals, one on each costal shield. The whole plastron, with the exception of a narrow yellow outer border, is black in the young. By the growth of the shields, the central part of the plastron becomes yellow in adults, with rays of black from the latero-posterior black areas on each shield. This change of pattern conditioned by growth is evidently the same as in *Clemmys mulica*. Deposits of extraneous red pigment are frequent.

"This species, like *Clemmys mutica* and *Ocadia sinensis*, is common near Nqdoa. Two eggs, apparently ready to be laid, were taken from one of these turtles on May 17th. They were oval, 27 mm. by 50 mm., with a hard white shell." (C. H. P.)

***Pyxidea mouhotii* (Gray)**

Figure 6

Cyclemys mouhotii GRAY, 1862, Ann. Mag. Nat. Hist., (3) X, p. 157. BOULENGER, 1889, 'Cat. Chelon. Brit. Mus.,' p. 132.

Pyxidea mouhotii GRAY, 1863, Proc. Zool. Soc. London, p. 175. SIEBENROCK, 1903, Sitzber. Akad. Wiss. Wien (math.-natur.), CXII, Abt. 1, p. 345, Pl. I, figs. 3-4; 1909, Zool. Jahrb., Suppl., X, p. 505.

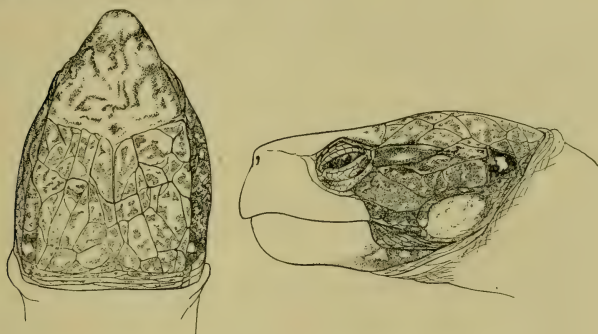


Fig. 6. *Pyxidea mouhotii*, A. M. N. H. No. 28336.
Head from above and from side, life size.

A single specimen of this species is in the collection, A. M. N. H. No. 28336, ♀. It was secured at Nam Fong.

The length of the carapace is 163 mm., its breadth 119 mm. The greatest depth is 67 mm. The length of the anterior lobe of the plastron is 70 mm.; of the posterior lobe 87 mm.; its width at the hinge 92 mm.; the width of the bridge 52 mm. The length of the tail is 35 mm. The lengths of the sutures between the shields of the plastron are as follows: gulars, 25 mm.; humerals, 17 mm.; pectorals, 28 mm.; abdominals, 36 mm.; femorals, 20 mm.; anals 30 mm.

The color of the carapace is a uniform light brown, each costal with a diffuse black marking at its upper posterior corner, below the lateral keel. The plastron is grayish brown, with scattered small black spots. The outer borders of the gulars, humerals, femorals, and anals are black, and there

is a lateral black spot on each pectoral and on one of the abdominals. The head is brown with black spotting or vermiculation, with a yellow spot, outlined with black, behind and above the tympanum.

The specimen agrees well with Günther's figure (1864, Rept. Brit. India, Pl. IV, fig. *D*), and with Boulenger's description. The retention of the separate genus, *Pyxidea* Gray, for it seems justified, if only by the striking difference in habitus between it and the more aquatic *Cyclemys*.

It was previously known from Siam and Indo-China, and it has not been recorded from Kwangtung, even in the extensive collections of Mell.

Trionychidæ

Amyda sinensis (Wiegmann)

Trionyx (*Aspidonectes*) *sinensis* WIEGMANN, 1834, Nova Acta Akad. Leop. Carol, XVII, p. 189.

Trionyx sinensis BOULENGER, 1889, 'Cat. Chelon. Brit. Mus.,' p. 256. SIEBENROCK, 1902, Sitzber. Akad. Wiss. Wien (math.-natur.), CXI, Abt. 1, p. 821, fig. 4; 1903, idem, CXII, p. 349; 1906, Zool. Anz., XXX, p. 581; 1907, Sitzber. Akad. Wiss. Wien (math.-natur.), CXVI, Abt. 1, p. 1741; 1909, Zool. Jahrb., Suppl., X, p. 601.

Amyda sinensis STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 524.

Four specimens of this species, A. M. N. H. Nos. 28344-28346, 30125, are in the collection from Hainan.

The measurements of these four specimens are as follows:

| A. M. N. H. No. | SEX | LENGTH CARAPACE | BREADTH CARAPACE | DEPTH | LENGTH PLASTRON |
|--------------------|------|--------------------|---------------------|--------|--------------------|
| 30125 | juv. | 47 mm. | 43 mm. | 17 mm. | 36 mm. |
| 28346 | ♀ | 103 | 86 | 29 | 77 |
| 28344 | ♀ | 177 | 154 | 50 | 134 |
| 28345 | ♀ | 236 | 194 | 74 | 183 |

The ventral pattern of this species is very distinct in the two smaller specimens, distinguishable in the next, and reduced to two diffuse lateral spots in the largest. It is invariable in general arrangement and appears to differ regularly from the pattern of *Amyda japonica* figured by Stejneger (1907, Pl. xxxv). I shall return to the interesting topic of variation in this species and its near relatives in connection with studies on the mainland specimens of *Amyda* collected by the Third Asiatic Expedition. There can be no question, however, of the applicability of the name *sinensis* (type locality near Macao) to the Hainan specimens at hand.

***Amyda steindachneri* (Siebenrock)**

Trionyx steindachneri SIEBENROCK, 1906, Zool. Anz., XXX, p. 579, Fig.; 1907, Sitzber. Akad. Wiss. Wien (math.-natur.), CXVI, Abt. 1, p. 1766, Pl.; 1909, Zool. Jahrb., Suppl., X, p. 600. VOGT, 1913, Sitzber. Ges. Naturf. Freunde Berlin, p. 225. MELL, 1922, Arch. Naturg., LXXXVIII, Abt. A, Heft 10, p. 110. VOGT, 1922, idem, p. 136.

A single female specimen, A. M. N. H. No. 28343, represents this well-characterized species in the present collection.

The nasal septum is provided with papillæ. The whole anterior border of the carapace is tuberculate. The carapace is set with spinose tubercles, not confluent into rows, heaviest posteriorly. The venter is diffusely mottled with gray, with no trace of large black spots. The pattern of the side of the neck, shown in Siebenrock's figure, is faint but distinguishable.

The length of the carapace is 161 mm.; its greatest breadth 135 mm.; greatest depth 50 mm.; length of plastron 127 mm.

***Pelochelys cantorii* Gray**

Figures 7 and 8

Pelochelys cantorii GRAY, 1864, Proc. Zool. Soc. London, p. 90, Figs.

Pelochelys cantoris BOULENGER, 1889, 'Cat. Chelon. Brit. Mus.,' p. 263, Fig. 69. SIEBENROCK, 1902, Sitzber. Akad. Wiss. Wien (math. natur.), CXI, Abt. 1, p. 832, Fig. 12; 1903, idem, CXII, Abt. 1, p. 350; 1909, Zool. Jahrb., Suppl., X, p. 607.

Two specimens of this form were brought to Nodda. A. M. N. H. No. 28342 consists of head and front legs, with the skull prepared, and No. 23541, Feb. 1923, is a complete skeleton.

The figure of the skull given by Gray is defective, and I have accordingly presented drawings of the skull and hyoid of the present specimen. The body of the hyoid is remarkable for the presence of four pairs of ossifications, a generic character which distinguishes *Chitra* and *Pelochelys* sharply from other Trionychidæ.

The species has not before been known from Hainan, but is known from Kwangtung.

SAURIA**Gekkonidæ*****Hemidactylus frenatus* Duméril and Bibron**

Figure 9

Hemidactylus frenatus DUMÉRIL AND BIBRON, 1836, 'Erpet. Gen.,' III, p. 366. BOULENGER, 1885, 'Cat. Lizards Brit. Mus.,' I, p. 120. BÆTTGER, 1894, Ber. Senck. Ges., p. 131. STEJNEGER, 1907, Bull. U. S. Nation. Mus. No. 58, p. 172, figs. 167-168. VOGT, 1913, Sitzber. Ges. Naturf. Freunde Berlin, p. 225. SMITH, 1923, Journ. Nat. His. Soc. Siam, VI, p. 197.

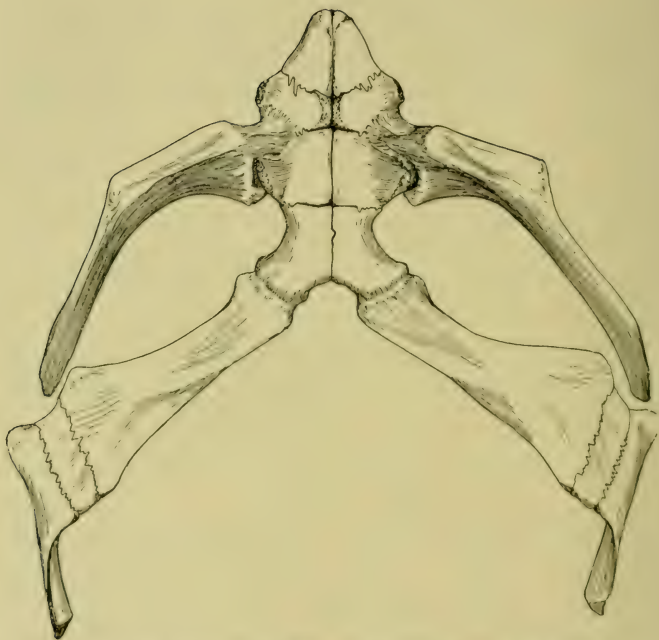


Fig. 7. Ventral view of hyoid of *Pelochelys cantorii*, A. M. N. H. No. 28342.
(Terminal series of ossifications wanting), life size.

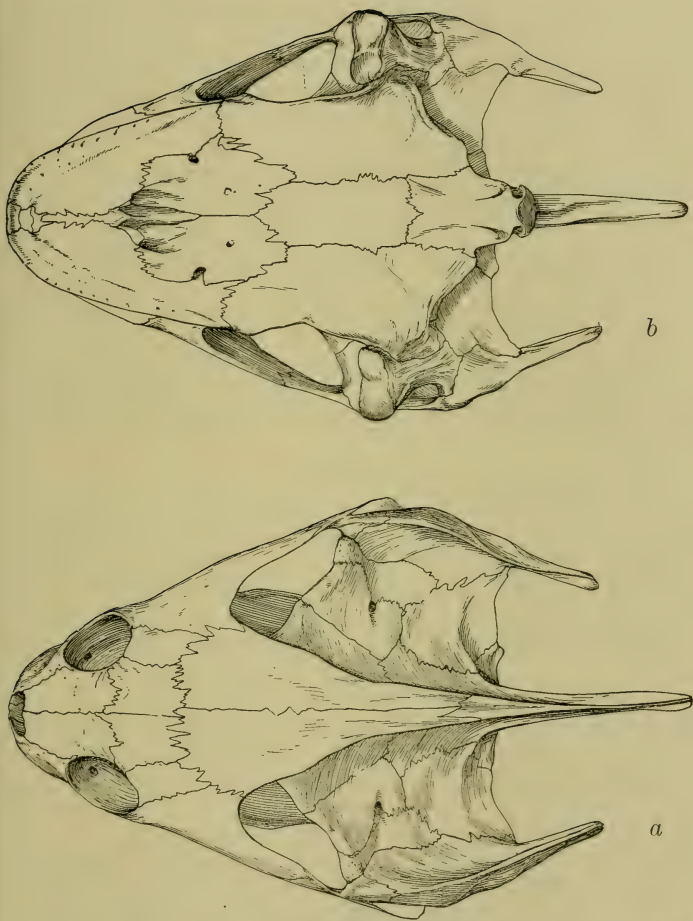


Fig. 8. Dorsal (a) and ventral (b) views of the skull of *Pelochelys cantorii*, A. M. N. H. No. 28342, life size.

One hundred and fifteen specimens of this species, A. M. N. H. Nos. 30298-30412, were collected at Nodda.

These specimens agree in their principal characters with published accounts of this species. They exhibit a surprising variability in the arrangement of their chin shields, contrasting with the constancy of this character in *Peropus mutilatus*.

In the present series, seventy-five specimens have two pairs of chin shields, seventeen have an extra one on one side, and twenty-three have three pairs of enlarged chin shields, of which the last may be either in



Fig. 9. Variation in the postmentals of *Hemidactylus frenatus*.

In A. M. N. H. Nos. 30320 and 30326 there are three pairs of chin shields, all in contact with the labials in the first, only two pairs in the second. In Nos. 30359 and 30325 there are two pairs of chin shields, both in contact with the labials in the former, only the anterior pair in the latter (an approach to the arrangement of *H. garnotii*). In No. 30303, the chin shields are separated by a small median postmental. All $\times 3$.

contact with the adjacent labials or separated from them. The length of the suture between the first pair is very variable. In two specimens they are separated by small granules. The second pair of these shields is separated from the labials in a single specimen, thus producing an arrangement very similar to the normal one in *Hemidactylus garnotii*. This variation is shown in the accompanying figures.

Hemidactylus garnotii is recorded from Hainan by Smith, but it is certainly not represented in the present collection. *Hemidactylus bowringii* may also be expected to occur in Hainan.

***Peropus mutilatus* (Wiegmann)**

Hemidactylus mutilatus WIEGMANN, 1834, 'Herpet. Mex.,' I, p. 54.

Peropus mutilatus GIRARD, 1858, 'Herpetol. U. S. Expl. Exp.,' p. 277. STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 180, Figs. 171-173.

? *Peripia peronii* SWINHOE, 1870, Proc. Zool. Soc. London, p. 239.

Thirty-nine specimens, A. M. N. H. Nos. 30413-30451, of this widely distributed species were collected in Hainan by Mr. Clifford H. Pope.

This form was recorded in Swinhoe's paper on Hainan reptiles in 1870, but the record is not confirmed by Boulenger, who lists *Hemidactylus frenatus* from Hainan, collected by Swinhoe, in the 'Catalogue of Lizards.' The fact that the species now reappears, and that it is evidently abundant in Hainan, seems to make it probable that Swinhoe

really did have some specimens of this species in his collections, though his record has been ignored in subsequent lists of Hainan reptiles.

The present series agrees excellently with the descriptions of Stejneger and Boulenger, and I find no important differences between the Hainan specimens and the large Polynesian series in the American Museum, collected by the Whitney South Sea Expedition.

"Among the live geckos we kept in a glass jar I noticed two distinct kinds, one with only four well-developed toes and spines on the tail, and one with five digits and a smooth, broad tail. The first of these (*Hemidactylus frenatus*) was a comparatively poor climber, and could not climb the vertical glass sides of the jar, while the other (*Peropus mutilatus*) could easily do so.

"I saw a *Peropus* deliberately lick the bottom of his digits. He held his front foot to his mouth and, by projecting his tongue, licked the under surfaces of his fingers with the under side of his tongue.

"About July 13th I saw the first very small gecko seen here, and others on July 18th, 24th, and 28th, evidently just hatched." (C. H. P.)

Agamidæ

Draco whiteheadi Boulenger

Draco sp., SWINHOE, 1870, Proc. Zoöl. Soc. London, p. 240.

Draco whiteheadi BOULENGER, 1899, Proc. Zoöl. Soc. London, p. 956, Pl. LXVI, fig. 1. BARBOUR, 1909, Proc. New England Zoöl. Club, IV, p. 63. SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 199.

Sixty-nine specimens, A. M. N. H. Nos. 30890-30958, of this species were secured near Nodoa, sixty of which were collected on December 12th and 16th, 1922.

Without a series of the mainland *Draco maculatus*, I am unable to form an opinion as to the degree of difference between these species. The coloration of the wings appears to be different. The color-pattern of the gular appendage in the male is variable; the colors are no longer discernible.

This species, like *Calotes versicolor*, apparently does not reproduce its tail.

This is another form not seen wild by Mr. Pope. It is evidently found only at a distance from Nodoa. The series mentioned was said to have come from six miles southwest of Nodoa, across the river.

Summary of Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------------------|-----|---------------------|------------|---------|
| Length of Body | ♂ | 51 | 39- 80 mm. | ..... |
| | ♀ | 18 | 37- 72 | ..... |
| Total Length | ♂ | 45 | 108-218 | ..... |
| | ♀ | 17 | 102-197 | ..... |
| Length of Tail | ♂ | 45 | 69-143 | ..... |
| | ♀ | 17 | 65-125 | ..... |
| Ratio of Tail to Total Length | ♂ | 45 | .62-.66 | .64 |
| | ♀ | 17 | .63-.66 | .64 |

"In my December field notes I have the following entry: Yesterday nineteen of the so-called 'flying-snakes' were brought in. They are lizards, of course. I tied a thread to the foot of one of them and tried letting him fall from various heights. The 'wings' were invariably spread as soon as the lizard was allowed to fall or move downward rapidly. When dropped from a fifteen-foot elevation it landed lightly on the grass below, although it fell nearly vertically; it did not attempt to glide. The 'wings' seem to be simply an aid to its jumps.

"Their protective coloration is almost as remarkable as the wings. When put in a basket over night, in which were a number of small branches, the lizards so arranged themselves as to be for the most part invisible. When I raised the lid in the morning, I thought that several must have escaped. Scrutiny revealed them stretched and flattened and fitted along the branches, legs clinging about the twig, and 'wings' pressed downward, not extended, so that the lizard's form was blended with and molded into that of the branch. Even the long thin tail was extended along the branch and not allowed to hang down. Their color blends perfectly with that of the bark. When annoyed, they are slow to move, as if realizing that their 'low visibility' is their best protection." (C. H. P.)

***Acanthosaura hainanensis* Boulenger**

Acanthosaura hainanensis BOULENGER, 1899, Proc. Zool. Soc. London, p. 957, Pl. LXVI, fig. 2.

Fifteen specimens, A. M. N. H. Nos. 30875-30889, were collected in the mountains south of Nodda and brought to Mr. Pope in July, 1923.

These agree with Boulenger's figure and description. *Acanthosaura crucigera*, with which Boulenger compared this species in the original description, is not available to me, but the Hainan series shows an astonishing agreement in color pattern with *A. lamoidentata*. From

the latter species they differ in the flat, smooth, dorsal and lateral scales, the intermixed larger ones being flat and keeled, while both large and small scales in *lamnidentata* are tubercular. In *hainanensis* the upper head scales are flat with a single keel, while in *lamnidentata* they are many-keeled or rugose.

The upper labials range from eleven to thirteen, the canthals and supraciliaries from ten to twelve.

The measurements of ten male specimens are as follows:

| | EXTREMES | AVERAGE |
|--------------|-------------|---------|
| Total Length | 197-252 mm. | 225 mm. |
| Body | 71- 88 | 80 |
| Tail | 129-164 | 145 |
| Arm | 44- 52 | 47 |
| Leg | 67- 79 | 73 |

“About the first of July I hired Li Ah-Sen and sent him into the Loi Country, into the high mountains to the south. He returned on the 5th with two specimens of *Acanthosaura hainanensis*. These lizards were brilliant green in life with a jet-black head. It is evidently a mountain form, as we have not bought a single specimen.” (C. H. P.)

Calotes versicolor (Daudin)

Agama versicolor DAUDIN, 1803, ‘Hist. Nat. Rep.,’ III, p. 395, Pl. XLIV.

Calotes versicolor FITZINGER, 1826, ‘Neue Class. Rept.,’ p. 49. SWINHOE, 1870, Proc. Zoöl. Soc. London, p. 240. BOULENGER, 1885, ‘Cat. Lizards Brit. Mus.,’ I, p. 331. BËTTGER, 1888, Ber. Offenbacher. Ver. Naturk, XXVI-XXVIII, p. 61; 1894, Ber. Senck. Ges., p. 131. COPE, 1895, Proc. Acad. Nat. Sci. Phila., (1894), p. 428. BOULENGER, 1899, Proc. Zoöl. Soc. London, p. 957. BARBOUR, 1909, Proc. New England Zoöl. Club., IV, p. 62. VOGT, 1913, Sitzber. Ges. Naturf. Freunde Berlin, p. 225. SMITH, 1923, Journ. Nat. Hist. Soc., Siam, VI, p. 199.

One hundred and five specimens, A. M. N. H. Nos. 30960-31064, of this species were collected at Nodoa.

Summary of Measurements and of Scales Around the Body

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------------------|-----|------------------|-------------|---------|
| Total Length | ♂ | 41 | 162-435 mm. | 323 mm. |
| | ♀ | 53 | 153-405 | 274 |
| Tail Length/Total Length | ♂ | 41 | .75-.78 | .765 |
| | ♀ | 53 | .75-.78 | .764 |
| Length of Hind Leg/BodyLength | ♂ | 44 | .74-.90 | .82 |
| | ♀ | 61 | .74-.90 | .82 |
| Scales Around Mid-body | ♂ | 44 | 40- 46 | 43 |
| | ♀ | 61 | 40- 47 | 44 |

Comparison material for the study of geographic variation in this species is not at hand. It seems likely that it may prove to be divisible into geographic races in the area from Afghanistan to Ceylon and Hainan, which constitutes its range.

"This is the commonest of lizards, their numbers undiminished in the mission compound in spite of all that were collected for us. They are essentially bush or tree inhabitants, usually seen descending a palm or on the garden wall, never seen on the ground except when apparently en route to some support. They employ the common trick of arboreal animals of keeping the trunk of the tree between themselves and an approaching person.

"During the winter I saw no brightly colored *Calotes*, and had replied in the negative to Mr. Leverett's question as to whether we had secured a red-headed tree-lizard. On March seventeenth I came upon a *Calotes* with head, throat, and shoulders crimson, with a black spot on each cheek. Recalling Mr. Leverett's query, I eagerly grabbed this specimen. Before I recovered my balance, a glance showed me that I was holding a brown-shouldered and brown-headed lizard, with no black spots, and only a little pale crimson on the throat. I have never seen a more sudden or complete color change." (C. H. P.)

***Leiolepis belli* (Gray)**

Uromastix belli GRAY, 1827, Zoöl. Journ., III, p. 216.

Lirolepis belli CANTOR, 1847, 'Cat. Malay Rept.,' p. 41. BOULENGER, 1885, 'Cat. Lizards Brit. Mus.,' I, p. 403. BETTGER, 1893, 'Kat. Rept. Mus. Senck.,' I, p. 55.

Lirolepis guttatus SWINHOE, 1870, Proc. Zoöl. Soc. London, p. 240.

Lirolepis reevesii STANLEY, 1914, Journ. N. China Branch Roy. Asiatic Soc., XLV, p. 25.

Two hundred and ten specimens of this species, A. M. N. H. Nos. 30666-30874, 30959, were secured in the neighborhood of Nodda.

The males of this species are characterized by their larger size and brilliant coloration. Juvenile specimens have three longitudinal, dorsal, light lines, which become broken up by the reticulate pattern between them with the growth of the individual.

Three to five of the subdigital lamellæ at the base of the third toe are strongly modified, suggesting the "comb" of *Cyclura* and the allied iguanid genera. So well defined a structure would be expected to have some definite function, the discovery of which must wait observations on this species in life.

The well-defined lateral fold at the base of the abdomen, whose edge is stiffened by prolongations of the posterior ribs, is a distinctive char-

acteristic which also awaits investigation from a student of the living animal. It seems possible that it may be an adaptation for burying the body in sand, like the broadening of the bodies of numerous desert-inhabiting lizards, and the adult pattern strongly suggests that of other sand-loving lizards. I quote the curious account of Swinhoe as to the function of this lateral expansion, as, although it seems a rather fanciful one, it may help to focus the attention of some observer on this point. Swinhoe's observations, at the least, require verification. Part of his account follows:

They lay basking in the sun, and when disturbed would run with great speed to the mouths of their holes, where they would stop short and turn their heads about. If not satisfied with what they saw, they popped at once into their holes. If surprised far from their holes, they spring into the air while running, and, expanding the loose red skin of their sides, skim along the surface of the sand for a considerable distance (say, often twenty yards at a time) and thus reach their retreats at greater speed. Their flight is not continued by flaps, but seems to be merely a long sustained leap, the body being made buoyant by the expanded side skin, and is analogous to the flight of the Flying-fish.

Variation in the labial scales, which appears to be independent of age and sex, is as follows:

| NUMBER OF UPPER LABIALS | NUMBER OF COUNTS |
|----------------------------|---------------------|
| 6 | 2 |
| 7 | 25 |
| 8 | 183 |
| 9 | 183 |
| 10 | 27 |

Variation in the number of femoral pores also seems to be unexpectedly independent of age and sex:

| NUMBER OF FEMORAL PORES | NUMBER OF COUNTS | | |
|----------------------------|------------------|----|------|
| | ♂ | ♀ | juv. |
| 12 | 3 | 3 | 2 |
| 13 | 52 | 16 | 24 |
| 14 | 82 | 29 | 54 |
| 15 | 61 | 29 | 31 |
| 16 | 12 | 12 | 5 |
| 17 | 2 | 1 | 2 |

Summary of Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|---------------|------|---------------------|-------------|---------|
| Total Length | ♂ | 87 | 236-438 mm. | 340 mm. |
| | ♀ | 40 | 197-320 | 263 |
| | Juv. | 58 | 155-234 | 193 |
| Ratio of Tail | ♂ | 87 | .64-.70 | .666 |
| Length to | ♀ | 40 | .64-.70 | .680 |
| Total Length | Juv. | 58 | .67-.70 | .686 |
| Ratio of Leg | ♂ | 106 | .61-.72 | .661 |
| Length to | ♀ | 45 | .62-.74 | .678 |
| Body Length | Juv. | 59 | .65-.77 | .718 |

"These lizards, whose local name is 'Pore-lung,' were uncommon until the first of March, when they began to appear in numbers. They are exceedingly abundant in the open rolling country, with sparse vegetation, about Nodoa.

"The Pore-lung is a swift runner, but takes refuge in his hole sooner or later, if pursued. A healthy rat-terrier gave chase to one and the lizard kept well in the lead for about 100 feet. Then he stopped short, and the terrier, after running past, came back and caught him.

"Their holes may be at the very edge of a well-frequented path. In general, the holes are inconspicuous and are concealed in the short grass. There is no mound at the opening, which is variable in shape, about an inch by an inch and a half. The holes extend for about two feet and at such an angle as to reach a depth of about one foot. They enlarge slightly below the ground. None were straight. Each hole was inhabited by a single lizard." (C. H. P.)

Varanidæ

Varanus salvator (Laurenti)

Stellio salvator LAURENTI, 1768, 'Syn. Rept.,' p. 56.

Varanus salvator CANTOR, 1847, 'Cat. Malay Rept.,' p. 29.

Varanus dracæni SWINHOE, 1870, Proc. Zool. Soc. London, p. 239.

Five *Varanus*. A. M. N. H. Nos. 31513-31517, were collected at Nodoa by Mr. Clifford H. Pope.

These agree excellently with Boulenger's description of *Varanus salvator* in every important character. Hainan and southern China represent the northeastern extreme of the range of this species.

In this series, the enlarged supraoculars are usually seven, eight occurring twice. The number of dorsal scales in a length equal to that of the occipital from the tip of the snout ranges from twenty-six to thirty,

nuchals in an equal length, counting from the posterior border of the skull, from twenty-four to twenty-eight. The scales between the occipital and the 'rostral' range from twenty-five to thirty. The transverse rows of ventrals, counted from the groin to the gular fold, number from eighty to ninety-three; the ventrals in a transverse row range from sixty-five to seventy-five. There is a distinct median groove on the snout.

"My hunter talks of monitors twelve feet long, but produces no evidence. The specimens secured came from Nam Fong, so it probably comes from the mountains south of that market.

"The first monitors brought in were very docile, and at most made half-hearted attempts to bite and to lash with their tails, with an occasional hiss. A female monitor, after egg-laying, became much more lively. When approached she raised herself on all fours, blew out her throat, hissed, and lashed with her tail. Her tail was a very effective whip, and was used like one; the little fox-terrier in the compound promptly learned to give her a wide berth. She was both deliberate and accurate with her blows.

"The ten eggs laid by this specimen were perfectly white, with a leathery shell. Their measurements range from 39×75 mm. to 41×80 mm. The egg-laying began on July 8th and was not completed until July 13th." (C. H. P.)

Lacertidæ

Takydromus sexlineatus meridionalis (Günther)

Tachydromus meridionalis GÜNTHER, 1864, 'Rep. Brit. India,' p. 70, Pl. VIII, fig. D.

Takydromus sexlineatus SMITH, 1923, Journ. Nat. Hist. Soc. Siam., VI, p. 200.

Two hundred and fourteen specimens of this form, A. M. N. H. Nos. 30452-30665, are in the Hainan collection.

This subspecies differs from *T. sexlineatus sexlineatus* in having twelve or more longitudinal rows of ventrals and never more than one femoral pore on each side.

The number of longitudinal rows of ventrals varies as follows:

| | ♂ | ♀ |
|---------|--------------|--------------|
| 12 Rows | 73 specimens | 77 specimens |
| 14 Rows | 25 specimens | 36 specimens |
| 16 Rows | ..... | 1 specimen |

Six specimens have more than the normal four rows of enlarged dorsals, two having five and four six. The frontonasal and rostral are in

contact in sixty-three specimens, separated in one hundred and fifty. One specimen has a small median scale between the supranasals. One specimen has gulars 3-2 and one 4-3, otherwise there are uniformly three on each side.

These lizards are very badly infested with mites, which usually attach themselves beneath the ventral scales. Sixty-five is the maximum number found on a single specimen.

Summary of Measurements and Scale Characters

| | SEX | NO OF SPECIMENS | EXTREMES | AVERAGE |
|---------------------------------|-----|--------------------|-------------|---------|
| Ventrals from Anal | | | | |
| Plate to Collar | ♂ | 98 | 20- 26 | 23 |
| | ♀ | 114 | 23- 28 | 25 |
| Lamellæ beneath | | | | |
| 4th Toe | ♂ | 97 | 17- 24 | .. |
| | ♀ | 114 | 17- 25 | .. |
| Length Hind Leg/ Body Length | ♂ | 98 | .44-.52 | .49 |
| | ♀ | 114 | .38-.49 | .44 |
| Total Length | ♂ | 27 | 180-240 mm. | 212 mm. |
| | ♀ | 16 | 166-224 mm. | 205 mm. |
| Tail Length/Total Length | ♂ | 27 | .76-.81 | .79 |
| | ♀ | 16 | .76-.80 | .79 |

"I have not seen a single specimen outside! A remarkable illustration of the possibility of missing an extremely common form entirely.¹ The natives began to bring them in in numbers about mid-April.

"One of these lizards laid five eggs in the laboratory on April 21st. The eggs are oval, nine to ten mm. in length, with a leathery shell." (C. H. P.)

Scincidæ

Mabuya multifasciata (Kuhl)

Scincus multifasciatus KÜHL, 1820, Beiträge Zool. Vergl. Anat., p. 126.

Mabuya multifasciata FREZINGER, 1826, 'Neue Class. Rept.,' p. 52. SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 200.

Mabuya multifasciata BETTGER, 1894, Ber. Senck. Ges., p. 131.

Forty-eight specimens of this species, A. M. N. H. Nos. 30250-30297, were collected at Nodoa.

¹It seems likely that this lizard inhabits bunch grass, and that both body form and coloration are highly 'protective,' as I have myself observed in long tailed anoles with a similar habitat (cf. Schmidt, 1921, Bull. Amer. Mus. Nat. Hist., XLIV, p. 14).

This proves to be a species with a small range of variability. The dorsal scales are nearly always tricarinate. Adult females may be distinguished by the white spots on the sides. All but three have six supraciliaries on each side, two having six on one side and five on the other, and one five on one side and four on the other. A single specimen has six upper labials on one side, seven being normal. The subdigital lamellæ beneath the fourth toe range from seventeen to twenty-one.

Female specimens are strongly spotted on the sides, each spot a white shaft confined to a single scale. The reproduced tail has transversely enlarged dorsal and ventral scales.

The maximum body length for the present series is 118 mm., in a female specimen with reproduced tail. The measurements of the largest specimen (male; A. M. N. H. No. 30286) with a complete tail are as follows:

| | |
|---------------|---------|
| Total Length | 310 mm. |
| Tail Length | 204 |
| Length of Arm | 35 |
| Length of Leg | 48 |

Summary of Measurements and Scale Characters

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|--|-----|---------------------|----------|---------|
| Scales around Mid-body | ♂ | 21 | 28- 31 | 30.0 |
| | ♀ | 20 | 29- 32 | 30.3 |
| Dorsals in a Longitudinal Row ¹ | ♂ | 21 | 40- 45 | 43 |
| | ♀ | 20 | 41- 46 | 43 |
| Ventrals from Anus to Mental | ♂ | 21 | 48- 55 | 52 |
| | ♀ | 20 | 48- 56 | 53 |
| Ratio of Leg Length to Body Length | ♂ | 21 | .41-.48 | .45 |
| | ♀ | 20 | .40-.47 | .42 |
| Ratio of Tail Length to Total Length | ♂ | 4 | .64-.66 | .65 |
| | ♀ | 3 | .63-.64 | .64 |

"This skink is to be seen everywhere in open bushy or grassy country and in thickets. It seems, however, to have a decided preference for the vegetation along streams. There it may be seen in the daytime walking about under the low growth. They draw themselves over the leaves, stopping frequently to look around. As soon as alarmed, off they go like a flash. When caught, they seem half stupified, but give one a good

¹Counted from a point opposite the anal cleft to the parietals.

nip now and then. I have seen them in the mission garden, but they keep within reach of shelter and do not venture on the open lawn." (C. H. P.)

***Sphenomorphus leveretti*,¹ new species**

Figure 10

TYPE.—A. M. N. H. No. 30201; ♂; Mountains south of Nodda, Hainan; July 1923; Clifford H. Pope.

DIAGNOSIS.—Allied to *Sphenomorphus indicus*, from which it may be distinguished by its more elongate snout; the longer and more pointed frontal; the much greater extension of the rostral shield on the upper surface of the snout; the longer dorsal and nuchal scales; twenty-two compressed lamellæ beneath the fourth toe; and a more spotted dorsal pattern, the lateral black band of *indicus* being represented only by numerous black spots, while the mid-dorsal area is heavily spotted with black, without the median black line occasionally found in *indicus*.

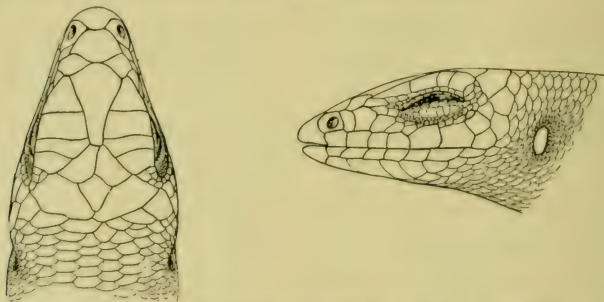


Fig. 10. *Sphenomorphus leveretti*, new species, A. M. N. H. No. 30201.

Head from above and from side, $\times 2$.

DESCRIPTION OF TYPE.—Rostral with a broad superior portion, about equal to two-thirds of the fronto-nasal, with which it makes a broad suture; no supranasals; nostril in a large nasal, which is bounded by the first labial, loreal, frontonasal, and rostral; anterior loreal little higher than the second, about two-thirds as long; seven upper labials, the fifth beneath the eye, fifth or sixth largest; frontonasal a little broader than long, in contact with the frontal; prefrontals moderate; frontal elongate, in contact with three supraoculars; four supraoculars; ten or eleven supraciliaries; lower eyelid with a semitransparent disc, which is composed of vertically elongate plates; fronto-parietals much larger than the interparietal; interparietal a little longer than wide; parietals in contact behind the interparietal; a row of five slightly enlarged nuchals bordering the parietals; temporals three in the first row, two in the second; ear opening oval, without lobules; a single large post-mental;

¹Named for Reverend Wm. J. Leverett, of the American Presbyterian Mission, Nodda, Hainan.

dorsal scales smooth, with faint striæ; four enlarged preanals, of which the middle pair is much the largest; thirty-seven scales around the middle of the body; no enlarged subcaudals; fingers and toes with smooth subdigital lamellæ, those of the toes strongly compressed, but not truly keeled, twenty-one and twenty-three under the fourth toes; sixty-four scales in a dorsal row from a point opposite the rear face of the thighs to the parietals.

Upper parts dark brown, with a metallic green sheen, with scattered black spots; sides heavily spotted with black; venter immaculate gray; a light line extends from the loreal beneath the eye to the ear, and continues as a less distinct one to the arm; limbs with light spots, (or a dark net work) above; head shields, especially prefrontals, frontal, supracoculars and labials, with black spots.

Measurements of Type and Paratypes

| A. M. N. H. No. | 30201 TYPE ♂ | 30200 ♂ | 30202 ♀ |
|-----------------|--------------|---------|---------|
| Total Length | 243 mm. | 243 mm. | ..... |
| Length of Body | 86 | 87 | 97 mm. |
| Length of Tail | 157 | 156 | ..... |
| Snout to Axilla | 35 | 36 | 36 |
| Axilla to Groin | 47 | 47 | 58 |
| Length of Arm | 28 | 29 | 28 |
| Length of Leg | 43 | 45 | 40 |

The paratypes agree with the type excellently in coloration; the frontal is in contact with two supracoculars on one side and three on the other in all three; enlarged nuchals are scarcely distinguishable; the dorsal scales from base of tail to parietals range from sixty-six to sixty-eight; scales around the body range from thirty-six to thirty-eight; subdigital lamellæ beneath the fourth toe range from twenty-one to twenty-three.

Leiolopisma reevesii (Gray)

Tiliqua reevesii GRAY, 1838, Ann. Nat. Hist., II, p. 292.

Hinulia reevesii GRAY, 1845, 'Cat. Lizards,' p. 76.

Eumeces reevesii GÜNTHER, 1864, 'Rept. Brit. India,' p. 87, Pl. x, fig. k.

Lygosoma nigropunctatum BOCOURT. 1878, Ann. Sci. Nat., (6) VII, Art. 16, p. 2. MOCQUARD, 1897, Bull. Mus. Hist. Nat. Paris, III, p. 213.

Lygosoma laterale (part) BOULENGER, 1887, 'Cat. Lizards Brit. Mus.,' III, p. 264.

Lygosoma laterale MELL, 1922, Arch. Naturg., LXXXVIII, Abt. A., Heft 10, p. 114. VOGT, 1922, idem, p. 137.

Leiolopisma laterale (1 part) STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 218

Leiolopisma laterale SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 200.

Forty-six specimens, A. M. N. H. Nos. 30204-30249, collected at Nodoa by Mr. Clifford H. Pope, are certainly referable to *Leiolopisma reevesii* Gray.

The Chinese lizards of this genus have been cited as a conspicuous instance of discontinuous distribution since their identification with *Leiopisma laterale* of the southern United States, first suggested by Boulenger in 1887. Stejneger, in 1907, followed Boulenger in referring Riu Kiu Island specimens to *laterale*. Van Denburgh, in 1912, for the first time dealing with adequate series, found at least three recognizable forms, respectively in Formosa, Ishigakishima, and Tsushima. He, however, maintains their connection with *laterale* by writing them as subspecies, and he identifies the Tsushima form with *L. reevesii* Gray. This close association of a Chinese and a North American species is not especially improbable, in view of the striking number of reptilian genera which have a North American—East Asian distribution.

The large series of Chinese *Leiopismas* now at hand, collected by Mr. Pope in Hainan and Hunan, and by Mr. Walter Granger in Szechwan, enable me to re-examine this question. Two conclusions seem evident: (1) that the south Chinese *Leiopisma reevesii* is distinct from the central Chinese *L. modestum*; and (2) that neither *reevesii* nor *L. modestum* is conspecific with *L. laterale*, *L. modestum* being the more closely allied.

The Hainan specimens form a series remarkably uniform in habitus, scale characters, and coloration. These must unquestionably be referred to *L. reevesii* Gray.

Gray, in the 'Catalogue of Lizards,' mentions the color character which is most distinctive of the present series, namely the presence of white spots in the dark lateral band. Günther's (1864) figure of the head of the type shows the broad contact of the prefrontals, also a characteristic of the present series. Finally, Mell has shown that Reeves' material came from south China. It is to be regretted that no Canton specimens of *Leiopisma* are at hand, but the extremely close agreement of the Hainan and Kwangtung faunas leaves no doubt in my mind that the Hainan series before me is authentic *Leiopisma reevesii* Gray.

It is by no means easy to draw up an infallible distinction between this *reevesii* and the American *laterale* based exclusively on scale characters, though the higher average of scale rows around the body and the usual meeting of the prefrontals in *L. reevesii* are nearly constant. The coloration, however, seems to be notably distinctive; *reevesii* has much more yellow in its coloration, has the lateral dark bar broken with light spots or vermiculation, has scattered dark spots on the lower sides, and frequently has a dark mid-dorsal line. When the tail is complete, the lateral line extends to its tip.

The arrangement of the prefrontals in the series examined is as follows:

| | BROADLY IN CONTACT | MEETING AT A POINT | SEPARATED |
|---------------------------------|-----------------------|-----------------------|-----------|
| <i>L. reevesii</i> ¹ | 42 | 3 | 1 |
| <i>L. modestum</i> | 6 | 16 | 54 |
| <i>L. laterale</i> | 5 | 3 | 42 |

The scales around mid-body are thirty in seventeen specimens, thirty-one in one, thirty-two in seven, and thirty-three in one. In specimens of *L. laterale* examined by Van Denburgh and myself, this count ranges from twenty-six to thirty, the latter figure only once in twenty-eight specimens.

The number of lamellæ beneath the fourth toe in *L. reevesii* ranges from sixteen to nineteen, and this character is in close agreement in *L. laterale*.²

Summary of Measurements and Scale Characters

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|--------------------------------------|-----|---------------------|-------------|---------|
| Scales Around Mid-body | ♂ | 18 | 30- 32 | 30.4 |
| | ♀ | 9 | 30- 33 | 31.2 |
| Dorsal Scales in a Longitudinal Row | ♂ | 18 | 66- 74 | 70 |
| | ♀ | 9 | 69- 76 | 73 |
| Lamellæ Beneath the Fourth Toe | ♂ | 18 | 16- 19 | 17.6 |
| | ♀ | 9 | 17- 19 | 17.8 |
| Length of Body | ♂ | 18 | 41- 48 mm. | 46 mm. |
| | ♀ | 9 | 47- 53 | 50 |
| Ratio of Leg-length to Body-length | ♂ | 18 | .31-.37 | .34 |
| | ♀ | 9 | .28-.33 | .31 |
| Total Length | ♂ | 10 | 123-136 mm. | 131 mm. |
| | ♀ | 4 | 133-136 | 135 |
| Ratio of Tail-length to Total Length | ♂ | 10 | .63-.67 | .65 |
| | ♀ | 4 | .62-.64 | .63 |

The number of dorsal scales from the posterior sides of the thighs to the parietals ranges from sixty-six to seventy-six in twenty-seven *reevesii*, averaging seventy-one compared with a range of from sixty-one to seventy-two and an average of sixty-eight, in twenty-eight *L. laterale*.

¹Smith records thirteen specimens, of which eight have the prefrontals in contact, four meeting in a point, and one separated.

²The specimen from Tsushima Island referred to *Leiolopisma laterale reevesii* by Van Denburgh appears to be amply distinguished from both *reevesii* and *modestum* by the small number of subdigital lamellæ beneath the fourth toe, twelve, compared with sixteen to nineteen in *reevesii*. For this specimen (Calif. Acad. Sci. No. 26134), I wish to propose the name **Leiolopisma vandenburghi**. It is an especial pleasure to attach the late Dr. Van Denburgh's name to this form, as he has led the way to an intelligible analysis of the oriental forms confounded with *L. laterale*.

L. reevesii is distinguished from *L. modestum* Günther, whose type locality is Ningpo, in part by the same characters which distinguish it from *L. laterale*. There is much more reason for a confusion of *L. modestum* with *laterale* than for the identification of *reevesii* with either. I shall return to this problem in a discussion of *L. modestum* in a subsequent paper of the present series.

"This is a very common little skink. I saw it most often in the late afternoon when it would run off the road ahead of me to rustle away in the grass. My collectors usually brought in four or five in a morning. There is a varying amount of red on the sides." (C. H. P.)

***Lygosaurus salsburyi*,¹ new species**

Figure 11

TYPE.—A. M. N. H. No. 30198; ♂; Nodoo, Hainan, China; 1923; Clifford H. Pope.

DIAGNOSIS.—Very clearly allied to *Lygosaurus sowerbyi* Stejneger, of Fukien, from which it may be distinguished by the greater number of subdigital lamellae. In *salsburyi* there are from nineteen to twenty-one lamellae beneath the fourth toe, compared with fifteen or sixteen in *sowerbyi*. In the present form the part of the frontal anterior to its constriction is about equal to the posterior part, while in *sowerbyi* the anterior part of the frontal is much shorter than the posterior portion.

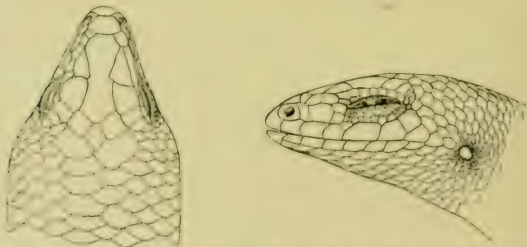


Fig. 11. *Lygosaurus salsburyi*, new species, A. M. N. H. No. 30199.

Head from above and from side, $\times 2$.

DESCRIPTION OF TYPE.—Habitus stout, with a moderately long conical tail, and short limbs; head not wider than the body, snout rather pointed, with sloping lores.

Rostral much broader than high; no supranasals; nostrils in rather large nasals; nasals in contact with the first labial, loreal, frontonasal, and rostral; two loreals, the first higher than broad, the second nearly square; six upper labials, fourth largest

¹Named for Dr. Clarence G. Salsbury of the American Presbyterian Mission, Nodoo, Hainan.

and beneath the eye; prefrontals small, widely separated, apparently continuous with the supraciliary series; frontal very large, more than twice as long as its greatest width, with a strong lateral notch made by the angle of the first supraocular; three large supraoculars followed by a pair of smaller ones; eight or nine supraciliaries; frontoparietals larger than the interparietal, which is in contact with the frontal; parietals small, with a considerable suture behind the interparietal; no enlarged nuchals; three temporals in each row, lower anterior largest; ear opening small, round, without lobules; dorsal scales with two distinct keels, between which a median faint one is frequently present, indistinct additional lateral keels less frequent, all rather faintly striate; twenty-eight scales around the middle of the body; no enlarged preanals; forty-five scales in a dorsal row from a point opposite the posterior face of the thighs to the parietals; nineteen and twenty-one subdigital lamellæ beneath the fourth toes; no enlarged scales beneath the tail.

Dorsal ground color light brown, lighter on the sides and the venter light yellowish brown; sides heavily spotted with vertical black spots, each usually at the base of a scale, and with a more or less distinct light spot behind it; these spots unite to form a distinct black band from shoulder to ear, enclosing two or three light spots; temples, in front of the ear-openings, heavily spotted; a few sharply defined black spots at the sides of the chin and throat; mid-dorsal area posteriorly and on the tail with scattered longitudinal black shafts on the centers of scales; venter immaculate.

Measurements of Type and Paratype

| A. M. N. H. No. | 30198 | 30199 |
|-----------------|---------|--------|
| Total Length | 171 mm. | ..... |
| Length of Body | 80 | 87 mm. |
| Length of Tail | 91 | ..... |
| Snout to Axilla | 30 | 31 |
| Axilla to Groin | 47 | 54 |
| Length of Arm | 16 | 17 |
| Length of Leg | 24 | 25 |

The single paratype agrees excellently with the type; one of its hind feet is lost and the tail is reproduced, with a short extra "nubbin" on one side. There are twenty-eight scales around the body; twenty subdigital lamellæ beneath the fourth toe; and forty-seven dorsal scales from the base of the tail to the parietals.

Eumeces quadrilineatus (Blyth)

Figure 12

Plestiodon quadrilineatus BLYTH, 1853, Journ. Asiatic Soc. Bengal, XXII, p. 652.

Eumeces quadrilineatus BOCOURT, 1879, 'Mission Sci. Mex.,' Rept., p. 423, Pl. XXII, D, fig. 5. BOULENGER, 1887, 'Cat. Lizards Brit. Mus.,' III, p. 381.

A single specimen of this species, A. M. N. H. No. 30197, ♂, was collected in the mountains south of Nodoa, July 30th, 1923, by a Loi collector for the expedition.

This form has not hitherto been recorded from Hainan. I append a description of the present specimen (A. M. N. H. No. 30197).

Habitus slender; head slightly swollen at the temples; tail stout, incomplete.

Supranasals in contact behind the rostral; nostril large, in the center of a single nasal; a postnasal nearly or quite as long as the first loreal; frontonasal broader than long, not in contact with rostral or frontal; prefrontals nearly as large as the frontonasal, in contact; anterior loreal higher than the second, about one-third as long; seven or eight upper labials, fifth or sixth beneath the eye, last largest; mental followed by two postmentals; frontal six-sided, the lateral sides nearly parallel, its length about equal to its distance from the end of the snout, in contact with the anterior three supraoculars; four supraoculars; eight supraciliaries; frontoparietals about equal to the interparietal, somewhat larger than the prefrontals; parietals meeting behind the interparietal; three pairs of nuchals; two temporals in the first

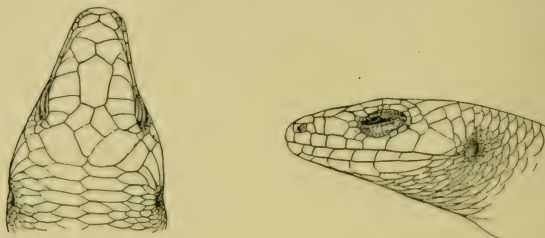


Fig. 12. *Eumeces quadrilineatus* Blyth, A. M. N. H. No. 30197.

Head from above and from side, $\times 2$

row, lower the larger; lower temporal of the second row little larger than the upper, wedge-shaped; two or three small lobules on the anterior border of the ear; soles of the hind feet with two series of enlarged tubercles, which extent from the heel to the bases of the third and fourth toes; twenty scales around the middle of the body; eighteen lamellae beneath the fourth toe; fifty-two dorsal scales from a point opposite the rear face of the thighs to the parietals.

Back very dark gray; head slightly brownish, venter light gray, yellowish gray beneath throat and tail; a pair of light dorsolateral lines extends from the parietals on the middle of the second scale row from the mid-dorsal line to the base of the tail, and these continue on the tail as broader lines, involving the outer part of the median two scale rows.

Measurements

| | |
|-----------------|--------|
| Length of Body | 72 mm. |
| Snout to Axilla | 26 |
| Axilla to Groin | 44 |
| Length of Arm | 22 |
| Length of Leg | 28 |

SERPENTES**Typhlopidae*****Typhlops braminus* (Daudin)**

Eryx braminus DAUDIN, 1803, 'Hist. Nat. Rept.,' VII, p. 279.

Typhlops braminus CUVIER, 1829, 'Regne Anim.,' 2nd Ed., II, p. 73. BÆTTGER, 1888, Ber. Offenbacher Ver. Naturk., XXVI-XXVIII, p. 70; 1894, Ber. Senck. Ges., p. 132; 1898, 'Kat. Rept. Mus. Senck.,' II, p. 1. STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 260, figs. 232-235. SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 200.

A series of thirty-seven specimens of this species was collected at Nodda (A. M. N. H. Nos. 28108-28144). They offer no appreciable variation from mainland specimens, or from published descriptions of this form. They range in length from 87 to 150 mm., and in diameter from 2.3 to 4 mm. The ratio of length to diameter varies from 34 to 48, the average being 41. The average length is 124 mm.

"This tiny snake is extremely abundant. An eight-year-old boy collected them for me during the spring by looking every week or so under the few dozen flower pots in the yards of the foreign houses. My Chinese servant swept one up in the yard." (C. H. P.)

Boidæ***Python bivittatus* Schlegel**

Python bivittatus SCHLEGEL, 1837, 'Phys. Serp.,' III, p. 403, Pl. xv, figs. 1-4. WERNER, 1921, Arch. Naturg., LXXXVII, Abt. A, Heft 7, p. 240.

Python molurus SWINHOE, 1870, Proc. Zool. Soc. London, p. 241. BOULENGER, 1893, 'Cat. Snakes Brit. Mus.,' I, p. 418 (part). BÆTTGER, 1894, Ber. Senck. Ges., p. 132.

Seven specimens of this species were secured by Mr. Pope at Nodda, A. M. N. H. Nos. 27804-27810.

In the uniform presence of suboculars the present series bears out Werner's distinction of *bivittatus* from *molurus*.

The specimens range in length from 2235 to 3353 mm. (skins). The tail-length ranges from .11 to .14 of the total. The dorsal scales, on the neck, at mid-body, and just before the vent, range from 54-65-40 to 62-72-44. The ventrals range in number from 255 to 262, average 258, and the subcaudals from 65 to 71, average 68. The upper labials are 12-12¹ in four specimens, 12-11 in two, and 11-11 in one. The lower labials vary from 18 to 20. The oculars, which encircle the eye, are 7-7 in four specimens, 6-7 in one, and 8-6 in one. The color pattern is apparently typical.

¹The two figures separated by a dash refer to the left and right sides of the specimen.

Swinhoe's remarks on this species are interesting. He says:

Two large Pythons were exposed in the market for sale at Taipingsze (Central Hainan) in February. They had been taken in the neighborhood, and I was told that the country people often brought them in. They were confined merely by a straw rope twisted around the neck. The natives declare that they are not hurtful to man and are easily caught by throwing over their heads a noose of twisted grass, and may with this be led about without danger. They call them Vang, and take them for the sake of their skin, heart, and liver. The skin is used chiefly for making drums, banjos, and other musical instruments, and the heart and liver, when dried and pounded, for stimulative medicine."

"A nine-foot python proved to be easily managed and could be handled freely. Teasing caused it to try to bite once or twice, but only at very close range. This specimen climbed a banyan tree and lay out upon the small limbs at the very top, so that we had to shoot the limb off to get it down. Its movements were slow and deliberate. A smaller specimen, six and a half feet long, was more agile in climbing and bit more viciously. Beyond a very slight tightening of the coils, neither of these snakes could be induced to constrict my forearm. Pythons seemed to be fairly common near Nodoa and apparently were not confined to any special habitat. We were told by the farmers that their dogs were responsible for the discovery of pythons." (C. H. P.)

Colubridæ

Sibynophis hainanensis, new species¹

Figure 13

TYPE.—A. M. N. H. No. R27788, ♂; Nodoa, Hainan, China; December 1922–July 1923; Clifford H. Pope.

DIAGNOSIS.—Closely allied to *Sibynophis collaris*; maxillary teeth 40; rostral just visible from above; upper labials 8; parietal in contact with the lower postocular; ventral plates 167, caudals 115.

DESCRIPTION OF TYPE.—Habitus of *S. collaris*; head moderately distinct from the body, body moderately slender, nearly cylindrical; tail long.

Maxillary teeth 40.

Rostral twice as broad as high, narrowly visible from above; internasals shorter than the prefrontals, but the internasal suture nearly equal to that of the prefrontals; nasal completely divided; loreal about as long as high; frontal longer than its distance from the end of the snout, much shorter than the parietals; one preocular and two postoculars; temporals 2–2 on each side; upper labials 8, the 3rd, 4th and 5th entering the eye on the right side, only the 4th and 5th on the left, a small anterior subocular being cut off from the third labial on that side; lower labials 10.

Dorsal scales all smooth, in 17 rows the whole length of the body, without apical pits; ventral plates 167; subcaudals 115; anal divided.

¹Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 2.

General color light grayish brown; a faint dark mid-dorsal line anteriorly; head and neck dark brown with three black crossbands, the first two obscure, the first on the posterior part of the supraoculars and the frontal; the second on the posterior part of the parietals; the third a broad nuchal collar, outlined posteriorly by a narrow white line; a sharply defined white line on the upper labials, outlined above by the brown head color, below by a narrow border of black; this light line extends from the nostril to the angle of the mouth, and is connected with its fellow by a line across the rostral; labial border white; venter white, each ventral plate with a pair of black dots at each end, which become confluent into continuous black lines posteriorly; chin with black dots; mental and first three lower labials each with a white spot outlined with brown.

Total length 483 mm., tail 177 mm., tail length .37 of the total.

RANGE.—Known only from Hainan.

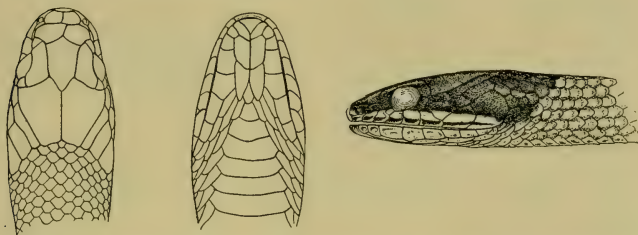


Fig. 13. *Sibynophis hainanensis*, new species, A. M. N. H. No. 27788, type.

Dorsal, ventral, and lateral views of head, $\times 2$.

If compared with Boulenger's synopsis of this genus (1893, p. 181), this Hainan form seems well distinguished from its nearest ally, *Sibynophis collaris*. Boulenger has since described *S. grahami* from Yunnan, and this approaches the present form in having only eight upper labials. It differs, however, in coloration, and has a much lower number of subcaudals (83), so that it can only be associated with the present form through *collaris*. Boulenger's reference of *Sibynophis sinensis* Günther, described from Ichang, Hupeh, to *collaris* is not convincing, and I am inclined to the opinion that *collaris*, *sinensis*, *grahami*, and *hainanensis* may prove to be rather intimately related subspecies of a single widespread form.¹

¹See Werner, 1926, p. 142.

***Natrix popei*, new species¹**

Figure 14

TYPE.—A. M. N. H. No. 27763, ♂; Nodoo, Hainan, China; December 1922–July 1923; Clifford H. Pope.

DIAGNOSIS.—Closely allied to *Natrix vibakari* and to *Natrix sauteri* of Formosa; maxillary teeth 20, the last gradually enlarged; anal divided; scales in nineteen rows; one or two anterior temporals; eight upper labials, fourth and fifth entering the eye; ventral plates 130–137; subcaudals 78–86; apical pits very faint, small, absent on most scales.

DESCRIPTION OF TYPE.—Size small, head moderately distinct from body, tail long.

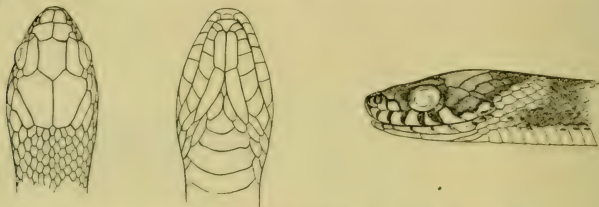


Fig. 14. *Natrix popei*, new species, A. M. N. H. No. 27763.
Dorsal, ventral, and lateral views of head, $\times 2$.

Maxillary teeth 20, gradually enlarged posteriorly.

Rostral vertical, only its edge visible from above, wider than high, its suture with the internasal about equal to that with the first labial; internasal suture about two-thirds as long as that of the prefrontals; nasal divided, nostril lateral; loreal nearly quadrangular, a little longer than high; one preocular and three postoculars; temporals 2-2 on each side, the upper anterior small; upper labials 8, the fourth and fifth entering the eye; lower labials 9, four in contact with the anterior chin-shields, which are shorter than the posterior; first pair of lower labials separated by the triangular mental.

Dorsal scales distinctly keeled, the outermost row smooth, in 19–17 rows; apical pits absent on most scales, occasionally present, but small and faint; ventral plates 133, subcaudals 78; anal divided.

General dorsal color dark brownish gray, lightest in two dorsolateral bands, in which are situated, on each side, a row of white, vertical, dark-edged spots, extending to about mid-body, absent posteriorly; venter white, a row of black spots on each side, one on each ventral, larger posteriorly and confluent into black latero-ventral lines; ventrals outside of these spots clouded with the dorsal color; each side of the neck with a broad light mark, the two nearly united dorsally; top of head, and lateral scales, with fine vermiculations or punctulations of white spots; a characteristic labial pattern of the *vibakari* type (compare Stejneger, 1907, fig. 240); first six labials white with black posterior edges; seventh white at the labial border, dark above, edged

¹Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 3.

with black; eighth with a flask-shaped white spot which reaches the labial border at the anterior corner; lower labials with narrow black marks on their sutures; loreal light, with dark margins.

Total length 356 mm., tail 107 mm., ratio of tail length to total, .30.

NOTES ON PARATYPES.—The paratypes (A. M. N. H. No. 27764, ♂, and 27765–68, ♀), agree excellently with the type. The first lower labials are in contact behind the mental in all; the dorsal scales are uniformly 19–17; the ventrals vary from 130 to 137, not differing in number in the sexes; subcaudals range from 78 to 86 in three specimens; labials and oculars are uniform with the type; temporals are 1–1 on both sides in three specimens, 2–1 in one, and 2–2 in one; maximum length 380 mm., tail length .29 to .32 of the total in three specimens; in three specimens the eighth labial spot is isolated, and fails to reach the labial border.

RANGE.—Known only from Hainan.

This species appears to be excellently distinguished from the Formosan *Natrix sauteri* by the higher number of ventrals, nineteen rows of dorsal scales instead of seventeen, and eight upper labials instead of seven. The coloration appears to be in close agreement, so far as can be judged from the description, and it is apparently very similar to that of juvenile *vibakari*, with which I believe both of these species to be allied. It is remarkable that the Hainan species proves to be more nearly allied to *vibakari* than the Formosan *sauteri*. The specimen of *vibakari* from Formosa referred to by Boulenger (1893, p. 222) is doubtless a *Natrix sauteri*. Mell (1922, p. 115) records *vibakari* from Kwangtung, without giving the characters of his specimens. These may prove to belong to the Hainan species.

***Natrix piscator* (Schneider)**

Hydrus piscator SCHNEIDER, 1799, 'Hist. Amphib.,' I, p. 247.

Natrix piscator MERREM, 1820, 'Syst. Amphib.,' p. 122. STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 288, Figs. 250–252. BARBOUR, 1912, Mem. Mus. Com. Zoöl., XLIV, p. 109. SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 201.

Tropidonotus quincunciatus BÜTTGER, 1888, Ber. Offenbacher Ver. Naturk., XXVI–XXVIII, p. 76.

Tropidonotus piscator BÜTTGER, 1894, Ber. Senck. Ges., p. 132; 1898, 'Kat. Rept. Mus. Senck.,' II, p. 22. WALL, 1903, Proc. Zoöl. Soc. London, p. 86.

One hundred and ten specimens of this widespread species attest its abundance in Hainan (A. M. N. H. Nos. 28145–28254).

This species is, upon the whole, very uniform and fixed in its characters. The present series of specimens agrees in coloration with Boulenger's series B (1893, p. 232). The supralabials in the whole series vary from 9 in only four specimens, one of which has 8 on both sides, and the other three 8 on one side and 9 on the other. The lower labials are more variable, usually 10, but the formula 9–10 occurs in seventeen

specimens, 9-9 four times, 8-9 once, 10-8 once, and 10-11 twice. The preocular is single except in one specimen, in which it is divided on one side. The postoculars are 2-2 in one specimen, 2-3 in one, 3-3 in seventy-eight, 3-4 in seventeen, 4 in eleven, 3-5 in one, and 4-5 in one. The first row of temporals is 1-1 in one specimen, 1-2 in two, 2-3 in one, and 2-2 in the remaining. In the second row there are 2-3 in seven, 3-3 in one, and 2-2 in the rest. The dorsal scales are normally 19-17, 19-17-15 occurring in ten specimens, 19-17-16 in six, 18-19-16 in one, and 17-18-15 in one.

The maximum length in the sixty-seven males is 668 mm., in the forty-three females 975 mm.

Summary of Ventrals, Caudals and Proportionate Tail-Length

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|----------------|-----|---------------------|----------|---------|
| Ventral Plates | ♂ | 67 | 122-133 | 126.5 |
| | ♀ | 43 | 134-145 | 138.2 |
| Subcaudals | ♂ | 51 | 73- 88 | 81.5 |
| | ♀ | 34 | 64- 77 | 71.5 |
| Tail-Length | ♂ | 51 | .29-.33 | .31 |
| | ♀ | 34 | .23-.28 | .24 |

Twelve stomachs contained remains of frogs, one the remains of a fish.

"This is perhaps the most abundant snake about Nodoa. It is found in all sorts of situations, but occurs in greatest numbers in wet, grassy places. It is especially abundant along the tiny streams just to the north of Nodoa.

"I frequently saw one that lived near a small pool in the corner of a rice field. It dashed into a hole in the clay bank whenever I appeared. One was taken in the mission compound.

"Some individuals have a row of red spots along either side, and these are apparently much less numerous than those without such spots." (C. H. P.)

Natrix stolata (Linnaeus)

Coluber stolatus LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 219.

Natrix stolatus MERREM, 1820, 'Syst. Amphib.,' p. 123. STEINER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 280, Figs. 244-246. BARBOUR, 1909, Proc. New England Zool. Club, IV, p. 67; 1912, Mem. Mus. Comp. Zool., XLIV, p. 110. SMITH, 1923, Journ. Nat. Hist. Soc. Siam., VI, p. 201.

Tropidonotus stolatus SWINHOE, 1870, Proc. Zool. Soc. London, 1870, p. 214. BETTGEL, 1888, Ber. Offenbacher Ver. Naturk., XXVI-XXVIII, p. 79. BOULENGER, 1893, 'Cat. Snakes. Brit. Mus.,' I, p. 253. BETTGEL, 1894, Ber. Senck. Ges., p. 132. VOGT, 1913, Sitzber. Ges. Naturf. Freunde Berlin, p. 225.

One hundred and seven specimens of *Natrix stolata*, A. M. N. H. Nos. 30001-30107, were collected in the vicinity of Nodoo, where it is evidently the most abundant terrestrial snake.

Like *Natrix piscator*, this species has a low range of variation in scale characters, and its color pattern is equally constant. The development of a lineate dorsal pattern in a terrestrial *Natrix* appears to be correlated with the Savannah habitat, paralleling the pattern-type of the North American *Thamnophis*.

The normal number of supralabials is eight, and this is departed from in only three specimens, in each of which the number is reduced to seven on one side. The lower labials are usually ten, eight occurring five times, nine seventeen times, and eleven six times, against ten in one hundred eighty-six counts. Two specimens have two preoculars on both sides, three have one on one side and two on the other, and the remaining series has the normal single preocular. The postoculars range from two to four, but are three on both sides in ninety-one specimens. The temporals are 1-1 on both sides in eleven specimens, 1-2 in fifty-eight, and 2-2 in five. The dorsal-scale rows are 19-17 in all except one specimen which has the irregular formula 19-18-16.

The maximum length in thirty-eight males is 634 mm., in twenty-eight females it is 687 mm.

Summary of Ventrals, Subcaudals and Proportionate Tail-Length

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 55 | 143-156 | 149 |
| | ♀ | 52 | 148-158 | 152 |
| Subcaudals | ♂ | 38 | 69- 87 | 80 |
| | ♀ | 28 | 70- 86 | 77 |
| Tail-Length | ♂ | 38 | .24-.28 | .26 |
| | ♀ | 28 | .23-.27 | .25 |

Five stomachs contained remains of *Microhyla* sp., and five remains of *Rana limnocharis*.

"This snake rivals *Natrix piscator* in abundance. Several were taken in the mission compound. It does not seem to be a water-snake. The bright yellow throat is a conspicuous recognition character.

"It is a very harmless and mild-tempered snake, and free handling would not cause it to bite. When attempting to escape, it glides away under even very short grass.

"Eggs apparently ready to be deposited measured 11 mm. by 15 mm." (C. H. P.)

Natrix subminiata (Schlegel)

Tropidonotus subminiatus SCHLEGEL, 1837, 'Phys. Serp.,' II, p. 313. VOGT, 1913, Sitzber. Ges. Naturf. Freunde Berlin, p. 225. STANLEY, 1914, Journ. N. China Branch Roy. Asiatic Soc., XLV, p. 28.

Natrix subminiata BARBOUR, 1912, Mem. Mus. Comp. Zool., XLIV, p. 111.

Four specimens, A. M. N. H. Nos. 27759-27762, agreeing with the *subminiata* of southeastern Asia, were collected at Nodoa.

The dorsal scale count in the single male specimen is 17-19-17, ventrals 149, and the tail is incomplete. In the three female specimens the dorsal scales are 19-17, 19-17-19-17, and 18-19-16, ventrals 155, 155 and 150, subcaudals 69, 73 and 71, respectively. Upper labials uniformly eight, the third, fourth and fifth entering the eye. The lower labials are ten, nine on one side in one specimen. There is a single preocular on both sides in one specimen, while the remaining three each have one on one side and two on the other. The postoculars are uniformly three. The temporals are invariably 2 in the first row, 2-3 in the second row in one specimen, 3-3 in one and 3-4 in one.

The largest specimen measures 810 mm., and the tail-length in the three female specimens is .22 or .23 of the total.

Barbour, (1912, p. 111), calls attention to the rather notable variation in the number of ventrals in this species and to its correlation with distinct geographic areas. In Upper Burma and Yunnan it appears to be represented by a form (whose scale counts do not overlap those of the lowland species) which I have distinguished as *Natrix helleri*.¹ A number of puzzling problems remain to be solved before the relations of the Javan and mainland forms can be expressed satisfactorily by means of subspecific classification.

Natrix andrewsi,² new species³

Figure 15

TYPE.—A. M. N. H. No. 28255, ♂; mountains south of Nodoa, Hainan, China; July 30, 1923; Clifford H. Pope.

DIAGNOSIS.—Subgenus *Macropophis*⁴ Boulenger. Maxillary teeth 37, uniform anteriorly, the last gradually enlarged; body very slender; eye large; all the scales strongly keeled, in nineteen rows; ventral plates 164, subcaudals 118; anal divided.

DESCRIPTION OF TYPE.—Body and neck slender, tail long, head distinct, the eye very large, its diameter equalling its distance from the rostral.

¹Amer. Mus. Novitates, No. 157, p. 3.

²Named for Mr. Roy Chapman Andrews, leader of the Third Asiatic Expedition.

³Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 2.

⁴The highly interesting assemblage of species now grouped under *Natrix* offers such interesting problems for a general revision that I have retained the present form in *Natrix*, although convinced that *Macropophis* merits recognition.

Rostral more than twice as broad as high, its suture with the first labial much less than that with the internasal; internasals and prefrontals quadrangular, the internasal suture about three-fourths as long as that of the prefrontals; nasal divided, nostril lateral; loreal nearly square on one side, trapezoidal on the other; one preocular and four postoculars on each side; temporals 2-3 on each side; nine upper labials, the fourth, fifth and sixth entering the eye; lower labials 9, five in contact with the first pair of chin-shields; both pairs of chin-shields very long, the second longest, in contact with the fifth and sixth labials and with the first ventral plate.

Dorsal scales in 19-17 rows, all strongly keeled, with faint apical pits some distance from the tip of the scale, which is notched; ventral plates 164; subcaudals 118; anal divided.

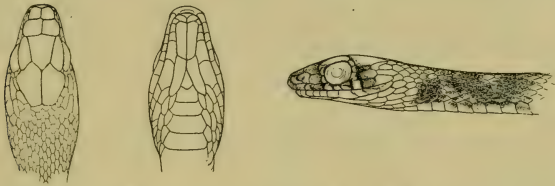


Fig. 15. *Natrrix andrewsi*, new species, A. M. N. H. No. 28255, type.

Dorsal, ventral, and lateral views of head, $\times 2$.

The color description is somewhat incomplete on account of the very deciduous scales, the specimen being otherwise well-preserved. Middle of back dark, the sides brownish, some of the lateral scales outlined with black; venter white, except ends of ventrals, which are punctate with black and black-tipped next to the first scale row; neck with a series of square light markings on each side, alternate, occupying the fourth to sixth scale rows; the first pair joins the diffuse, broad light nuchal band; top of head brown; a sharply defined vertical white bar on each side of the eye, the anterior one extending from the supra-ocular across the preocular and the fourth labial, the posterior on the postoculars, lower corner of the first lower temporal, and the middle of the seventh labial; both of these light bars are margined with black; the fifth and sixth labials each have a semicircular white spot; anterior labials brown; eighth labial brown, the ninth involved in the lighter nuchal band.

Total length 800 mm., tail-length 303 mm., ratio of tail to the total length, .34.

RANGE.—Known only from Hainan.

This species is evidently allied to *Natrrix dendrophiceps* Günther in dentition and habitus. It is apparently a very distinct form, otherwise unrelated to the Chinese or even Oriental water-snakes, unless it be *Natrrix maculatus* Edeling, which has a very different dentition.¹

¹Evidently identical with *Natrrix ornaticeps* (Werner). While it is probable that Werner's paper (dated 1924) is the prior one, I reserve the necessary synonymic changes pending conclusive evidence on this point.

Trimerodytes balteatus Cope

Trimerodytes balteatus COPE, 1895, Proc. Acad. Nat. Sci. Phila., 1894, p. 426, Pl. x, fig. 2.

Tropidonotus balteatus BOULENGER, 1896, 'Cat. Snakes Brit. Mus.,' III, p. 607.

Liparophis bedoti PERACCA, 1904, Rev. Suisse Zool., XII, p. 663. STEINDACHNER, 1906, Sitzber. Akad. Wiss. Wien (math.-natur.), CXV, Abt. 1, p. 905, Pl. MELL, 1922, Arch. Naturg., LXXXVIII, Abt. A, Heft 10, p. 118. VOGT, 1922, idem, p. 139.

Examination of two specimens of *Trimerodytes balteatus*, A. M. N. H. Nos. 27751-27752, from Nodoa leaves no possible doubt as to the identity of *Liparophis bedoti* with this species. The confusion is the evident result of Boulenger's rather offhand reference of *Trimerodytes* to *Tropidonotus*. This was the less justifiable as he described *Tapinophis* only a few years later, which, in turn, is doubtfully distinct from *Trimerodytes*, the differences in any case being not of generic value in Boulenger's own practice.

Scale Characters and Measurements

| MUSEUM NUMBER | A. N. S. P. (Type) | A. M. N. H. 27751 | A. M. N. H. 27752 | GENEVA Type of <i>L. bedoti</i> |
|---------------------------------|-----------------------|----------------------|----------------------|---------------------------------------|
| Sex | | ♂ | ♂ | |
| Dorsal Scales | 19 | 19-17 | 19-17 | 19 |
| Ventrals | 202 | 202 | 205 | 196 |
| Caudals | 84 | 38 | 85 | 55 |
| Upper Labials | 9 | 8-9 | 9-8 | 9 |
| Lower Labials | 9 | 9-8 | 8-9 | ..... |
| Pre + Postoculars | 1+2-3 | 1+2 | 1+2 | 1+2-3 |
| First + Second Row of Temporals | 1 2 | 1 2 | 1 $\frac{2}{3}$ | 1 2 |
| Total-Length | 377 mm. | 536 mm. | 597 mm. | 717 mm. |
| Tail-Length | .21 | .12 | .21 | .14 |

The only noteworthy difference to be explained in *L. bedoti* is the low number of subcaudals and the short tail, and this is amply accounted for by the short-tailed specimen at hand, which evidently has a broken tail but which has healed so perfectly that without the second specimen for comparison it might have passed as a complete one.

As there are three excellent descriptions of this species extant, it seems unnecessary to add to them. The specimens described and figured by Steindachner had complete tails, ranging from .20 to .23 of the total length. There is some anomaly in the specimen described by Moll and Vogt, as with 72 caudals its tail-length is only .14 of the total.

The color pattern of dorsal rings split by a narrow light band is very striking. It is evidently derivable from that of *Natrix percarinata*,

to which *Natrix æquifasciata* Barbour is closely allied. The number of black rings in the present specimens is fifty and fifty-five, slightly higher than the number reported by Steindachner.

This species is now recorded from Indo-China ("Cambodia and Tonkin") by Steindachner, and from Wutsung, Kwangtung, by Mell.¹

"This species is quick and alert in its movements. It glides along in short grass with the body nearly straight. I could not persuade it to bite or even to assume a defensive position. When handled it does not hold itself rigid but hangs with muscles relaxed. It has the rather unusual habit of backing up over an obstruction, or backing into a hole or into a sack." (C. H. P.)

Pseudoxenodon melli Vogt

Figure 16

Pseudoxenodon melli VOGT, 1922, Arch. Naturg., LXXXVIII, Abt. A, Heft 10, p. 139. MELL, 1922, idem, p. 118, Pl. IV, fig. 3. SMITH, 1923, Journ. Nat. Hist. Soc Siam, VI, p. 202.

A single specimen, A. M. N. H. No. 27753, from the mountains south of Nodoa, Hainan, is referable to this recently described species, which has been recorded from Hainan by Smith.

In its larger and more distinct head and its bold color pattern, this form contrasts strongly with other species of *Pseudoxenodon*. The present specimen presents some differences from Vogt's description, but it agrees in most characters, and its coloration and habitus are excellently shown in Mell's figure.

The differences in scale characters, together with those of *P. bambusicola* Vogt, are shown in the following tabulation:

| | A. M. N. H. 27753 | MALCOLM A. SMITH COLL. | TYPE OF <i>P. melli</i> | TYPE OF <i>P. bambusicola</i> |
|---------------------------------------|----------------------|---------------------------|----------------------------|----------------------------------|
| Sex | ♂ | ♀ | ? | ? |
| Dorsal Scales | 19-17-15 | ..... | 19-17-15 | 19-17-15 |
| Ventrals | 140 | 141 | 136 | 132 |
| Subcaudals | 52 | 47 | 38 | 56 |
| Upper Labials | 8 | ..... | 8 | 8 |
| Pre+Postoculars | 1+3 | ..... | 1+3 | 1+2 |
| First and Second Rows of Temporals | 2-2 | ..... | 2-2 | 2-3 |
| Total-Length | 618 mm. | 500 mm. | 330 mm. | .... |
| Tail-Length | 102 | 80 | 45 | .... |
| Ratio, Tail to Total | .16 | .16 | .13 | |

¹Werner's reference of this species to *Lisparophis* Peracca (Werner, 1926, p. 141) is of course untenable. Nor is it possible to maintain Peracca's species on the basis of a difference in coloration.

It will be seen that the Hainan specimen agrees in number of subcaudals with *bambusicola*. Vogt fails to mention the sex of his specimens, and the difference in tail-length between *bambusicola* and *melli* might well be a sexual one. Mell's field notes, however, indicate that he found the two forms in distinct habitats and geographic areas, and *bambusicola* may therefore be retained in spite of the fact that the present specimen bridges the gap between the two species.¹ The close agreement of the female specimen described by Smith from Nam-kaio, Hainan, with the present specimen, indicates that Vogt's type may have had an unusually

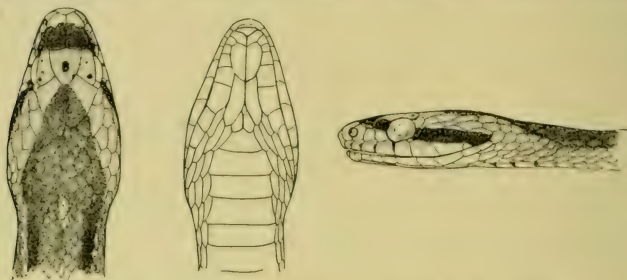


Fig. 16. *Pseudozenodon melli* Vogt, A. M. N. H. No. 27753.
Dorsal, ventral, and lateral views of head, life size.

low number of subcaudals, or possibly an incomplete tail. Both of the two known Hainan specimens have the second pair of chin shields equal to the first, and five lower labials in contact with the first pair.

In Boulenger's description of the genus (1893, p. 270), apical pits are said to be wanting. I find them evident in this form, and they may be distinguished, by attentive examination, in *P. sinensis*.

***Lycodon subcinctus* Boie**

Lycodon subcinctus BOIE, 1827, Isis, p. 551. BOULENGER, 1893, 'Cat. Snakes Brit. Mus.,' I, p. 359. SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 202.

The single specimen collected by Mr. Pope at Nodda, A. M. N. H. No. 27755, is the second record of this species from Hainan, and it is as yet unknown from the Chinese mainland. It seems to be indistinguishable from the East Indian representatives of the species.

¹Werner (1926, p. 144) determines the type of *bambusicola* as the ♂ of *melli*; *P. bambusicola* has page priority over *melli* and is preferred by Werner, who may be regarded as first revisor. It should be employed in future for the form here described.

The dorsal scales are in 17-17-15 rows; ventral plates 197, subcaudals 77; upper labials 8 on each side; oculars 0-2; temporals 1-2. The total length is 564 mm., tail 112 mm., ratio of tail to length, .20.

Maxillary teeth 5+6, the anterior group strongly enlarged posteriorly, the posterior group subequal. The angular bend of the maxilla at the toothless interspace is much less marked than in *Lycodon aulicus*.

"The first specimen of this species was brought August 1st by the mission carpenter from the mission compound.

"While resembling the Krait in general appearance, the behavior of this species is radically different. It moves quickly through, or over, the short grass, with its head slightly raised. It could not be made to assume a defensive position, but would strike while in motion. When held down with a stick, it would strike with speed and vigor. The tail was repeatedly vibrated." (C. H. P.)

***Ptyas mucosus* (Linnæus)**

Coluber mucosus LINNÆUS, 1758, 'Syst. Nat.,' Ed. 10, I, p. 226.

Ptyas mucosus COPE, 1860, Proc. Acad. Nat. Sci. Phila., p. 563. BÆTTGER, 1888, Ber. Offenbacher Ver. Naturk., XXVI-XXVIII, p. 75. STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 345, Figs. 298-300. SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 202.

Zamenis mucosus, BÆTTGER, 1894, Ber. Senck. Ges., p. 133; 1898, 'Kat. Rept. Mus. Senck.,' II, p. 41.

Eleven specimens, A. M. N. H. Nos. 27820-27830, of this widespread species were obtained.

There is no important variation to record. The upper labials are 8-9 in one specimen, 8-8 in the remaining; the lower labials are 9-10 in one, 10-10 in the rest; preoculars and postoculars invariably two; two anterior temporals, and one, two, or three in the second row, one appearing once, two fourteen times, and three seven times. The loreals vary from three to five, six specimens having three on each side, while four have four on each side and one has five on one side, four on the other.

The dorsal scale rows are 21 or 19 on the neck, invariably 17 at mid-body, and invariably 14 near the tail. The median row is lost opposite the 102d to 120th ventral, and the third row of each side is dropped a short distance farther back. The full scale formula for this form is therefore 21-19-17-16-14. The keels of the median four to six dorsal scale rows begin about mid-body, the anterior dorsals being perfectly smooth.

The largest male specimen measures 2118 mm., the largest female 1518 mm.

Summary of Ventrals, Caudals and Proportionate Tail-Length

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 7 | 194-200 | 197 |
| | ♀ | 7 | 193-200 | 196 |
| Caudals | ♂ | 7 | 112-118 | 116 |
| | ♀ | 7 | 111-118 | 114 |
| Tail-Length | ♂ | 2 | .24-.26 | .25 |
| | ♀ | 4 | .25-.27 | .26 |

"This snake is the most abundant large snake of the region. I saw one myself as it crossed the road in front of me half-way between Nodoa and Nam Fong.

"Its temperament is surprisingly inoffensive. When handled, it often wraps a loop around one's arm, tucking in the tail and exerting considerable pressure. When teased, its only reaction is an attempt to escape. When cornered, it inflates the neck and hisses." (C. H. P.)

Ptyas korros (Schlegel)

Coluber korros SCHLEGEL, 1837, 'Phys. Serp.,' II, p. 139.

Ptyas korros COPE, 1860, Proc. Acad. Nat. Sci. Phila., p. 563. BOETTGER, 1888, Ber. Offenbacher Ver. Naturk., XXVI-XXVIII, p. 75. STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 348. SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 202.

Zamenis korros BOULENGER, 1893, 'Cat. Snakes Brit. Mus.,' I, p. 384. BOETTGER, 1894, Ber. Senck. Ges., p. 75; 1898, 'Kat. Rept. Mus. Senck.,' II, p. 41. STANLEY, 1914, Journ. N. China Br. Roy. Asiatic Soc., XLV, p. 27.

Nine male specimens, A. M. N. H. Nos. 27811-27819, represent this form in the present collection.

The upper labials are uniformly 8; the lower labials 10 in seven specimens, 9-10 in one, 8-9 in one; three preoculars on one side of one specimen, otherwise regularly two; two postoculars; temporals 2-2 on each side except in one specimen, which has 2-3 on one side; loreals 2 on both sides in four, 3 in three, and 2-3 in two specimens.

The dorsal scales are in seventeen rows anteriorly in two specimens, fifteen in the remaining seven, uniformly fifteen at mid-body and eleven posteriorly.

No. 27811, measuring 405 mm. in length, shows the juvenile pattern of narrow white transverse lines across the anterior part of the body.

Summary of Ventrals, Caudals and Proportionate Tail-Length

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 9 | 165-175 | 168 |
| Caudals | ♂ | 7 | 128-141 | 134 |
| Tail/Total Length | ♂ | 7 | 34-36 | .35 |

"This species is fairly abundant. It is quick in its movements. When held by the neck, it makes the usual violent effort to escape of a whip-snake, thrashing the body and twisting upon itself. It did not have a special defensive attitude, but when teased would follow the annoying object with its head and occasionally bite rather ineffectually. On being teased, one specimen would bite itself viciously several times."

C. H. P.

***Elaphe porphyracea* (Cantor)**

Coluber porphyracea CANTOR, 1839, Proc. Zool. Soc. London, p. 51. BOULENGER, 1894, 'Cat. Snakes Brit., Mus.,' II, p. 34.

Elaphe porphyracea BARBOUR, 1912, Mem. Mus. Comp. Zool., XLIV, p. 195.

Two specimens of this extremely distinct species are at hand from Hainan, A. M. N. H. Nos. 27757-27758, the first record of this form from the island.

The coloration agrees in general with that of mainland specimens. There are eleven black cross-bands on the body of the smaller specimen, with two on the tail. The posterior cross-bands are fainter in both specimens, and only nine can be distinguished in the larger. The dorsolateral black lines are less complete in the smaller specimen. The characteristic head-pattern is present.

Scale Characters and Measurements

| A. M. N. H. No. | 27757 | 27758 |
|-------------------|---------|---------|
| Sex | ♂ | ♂ |
| Dorsal Scales | 19-17 | 19-17 |
| Ventrals | 198 | 202 |
| Caudals | 75 | 79 |
| Upper Labials | 8 | 8 |
| Lower Labials | 10 | 10 |
| Preoculars | 1 | 1 |
| Postoculars | 2 | 2 |
| Temporals | 1-2 | 1-2 |
| Total Length | 736 mm. | 817 mm. |
| Tail-Length | 140 | 156 |
| Tail/Total Length | .19 | .19 |

***Elaphe tæniura vaillanti* (Mocquard)**

Coluber vaillanti MOCQUARD, 1905, Bull. Mus. Hist. Nat. Paris, XI, p. 76; Bull. Soc. Philom. Paris, (9) VII, p. 319, Fig. 2.

A single *Elaphe* of the *tæniura* group, A. M. N. H. No. 27756, was bought by Mr. Pope at Nam Fong.

This specimen agrees excellently with the figure given by Mocquard, and differs in both pattern and scale characters from typical *tæniura*.

Top of head uniform grayish brown; chin and supra-labials yellowish; a black stripe on the side of the head, faint from the nasal to the eye, distinct from the eye to the angle of the jaw; neck, for a distance equal to about four head lengths, uniform grayish brown; behind this are bold black longitudinal markings, in four rows, on the 2d-5th and 8th-10th scale rows; those of the lower row alternate with those of the upper, the upper with a slight tendency to be connected across the back to form an H-shaped mark; about mid-body these markings become faint; posterior to this, the black markings of each side unite to form a solid broad longitudinal band, leaving a sharply defined light line on the mid-dorsal and adjacent half scale rows; a well-marked light lateral stripe on the lower half of the first scale row and the ends of the ventrals borders the dark bands below; ventrals yellowish, mottled with gray at their ends; posteriorly this gray mottling unites to outline the lateral light lines, leaving a fourth light, mid-ventral, line; all four light lines continued to the tip of the tail; no vertical white bars on the dark lateral longitudinal bands.

Scale Characters and Measurements

| | A. M. N. H. No. | TYPE OF |
|---------------------------|-----------------|------------------|
| | 27756 | <i>vaillanti</i> |
| Dorsal Scales | 25-23-19 | 23 |
| Ventrals | 259 | 256 |
| Caudals | 120 | 106 |
| Upper Labials | 9 | 9 |
| Lower Labials | 11 | .. |
| Preoculars | 2 | 2 |
| Postoculars | 2 | 2 |
| Temporals | 2-3 | 3- |
| Total-Length ¹ | 1960 mm. | |
| Tail-Length | 465 | |
| Tail/Total Length | .24 | |

Stejneger (1907, p. 319) has given an excellent account of the typical form of this species. He states that *Elaphe schmackeri*, to which the present specimen is most closely allied in scale characters, has the coloration of typical mainland *teniura*. This is not the case in the Hainan and Tonkinese specimens, whose pattern is strikingly different in detail from central Chinese specimens, though agreeing in general plan.

The high number of subcaudals in the Hainan specimen is equalled only in *schmackeri*, and, were the latter not also an insular form, it would certainly have to be united with *teniura* as a subspecies. It seems prefer-

¹A skin, with head attached, measurements therefore unreliable.

able to retain *vaillanti* for the southeastern form of *tæniura*, its chief distinguishing character being the absence of the numerous dark anterior dorsal crossbars of northern *tæniura* and of *schmackeri*.

***Ahætulla boiga* (Lacépède)¹**

Coluber boiga LACÉPÈDE, 1789, 'Hist. Nat. Serp.,' II, pp. 102 (Tabl. Method.) and 223 (text).

Dendrophis pictus BOULENGER, 1894, 'Cat. Snakes Brit. Mus.,' II, p. 78.

A single specimen in the Nodda collection adds this species to the Hainan fauna, A. M. N. H. No. 27754, collected July 28, 1923.

Scale Characters and Measurements

| | |
|-------------------|----------|
| A. M. N. H. No. | 27754 |
| Sex | ♀ |
| Dorsal Scales | 15-13-11 |
| Ventrals | 191 |
| Caudals | 155 |
| Upper Labials | 9 |
| Lower Labials | 10 |
| Preoculars | 1 |
| Postoculars | 2 |
| Temporals | 2-2 |
| Length | 944 mm. |
| Tail-Length | 322 |
| Tail/Total Length | .34 |

This specimen differs from the descriptions of Oriental representatives of the species in lacking the lateral stripe on the lowermost scale row.

***Holarchus violaceus* (Cantor)**

Coronella violacea CANTOR, 1839, Proc. Zoöl. Soc. London, p. 50.

Simotes sp., SWINHOE, 1870, Proc. Zoöl. Soc. London, p. 240.

Simotes violaceus BOULENGER, 1894, 'Cat. Snakes Brit. Mus.,' II, p. 222; 1896, idem, III, p. 640. STANLEY, 1914, Journ. N. China Br. Roy. Asiatic Soc., XLV, p. 27.

Holarchus dolleyanus COPE, 1895, Proc. Acad. Nat. Sci. Phila., 1894, p. 423, Pl. x, fig. 1.

Holarchus violaceus STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 354. SMITH, Journ. Nat. Hist. Soc. Siam, VI, p. 203.

Forty-three specimens of this species are in the collection, A. M. N. H. Nos. 27867-27909.

The upper labials, in this series, range from five to eight, eight being the most frequent number. The lower labials vary from six to eight,

¹The use of this name for *Dendrophis pictus* auct. was suggested to me, in conversation, by Dr. Leonhard Stejneger, and it is here employed for the sake of uniformity with Dr. Stejneger's future publications on Chinese herpetology.

seven and eight being nearly equally frequent. The preocular is single forty times, two forty-six times. The postoculars are regularly two in number, but are single on both sides in six specimens. The anterior temporal is normally single, but two occur ten times, and in one specimen the parietals meet the upper labials on both sides. The second row of temporals contains two scales in fifty-nine cases, one in twenty-four, and three in three. Undivided subcaudals appear in three specimens, from one to four in number.

The fourth dorsal scale row drops out between the eightieth and ninetieth ventrals, at about mid-body. The number of rows varies from 17-15 to 15-13, as follows:

| DORSAL ROWS | NO. OF SPECIMENS |
|-------------|---------------------|
| 17-17-15 | 35 |
| 15-17-15 | 1 |
| 17-15-13 | 4 |
| 15-15-15 | 2 |
| 15-15-13 | 1 |

The largest male measures 562 mm., the largest female 480 mm.

Summary of Ventrals, Caudals and Proportionate Tail-Length

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 23 | 157-168 | 164 |
| | ♀ | 20 | 161-173 | 167 |
| Caudals | ♂ | 23 | 35- 45 | 38 |
| | ♀ | 20 | 30- 39 | 34 |
| Tail/Total Length | ♂ | 23 | .13-.15 | .14 |
| | ♀ | 20 | .11-.14 | .12 |

The coloration of this series agrees with that of Boulenger's series B, for which the name *swinhonis* Günther, type locality Amoy, is available, should it prove desirable to separate the Chinese from the Indian form. The type locality of *violaceus* is Rungpore (= Rangpur), N. E. India.

"This species seems to be one of the commonest snakes in the open grassy country around Nodoa. I met with several myself in the late afternoon.

"When handled, one of these snakes rarely attempts to bite but coils around one's hand and presses against it vigorously with the sharp tip of its tail. One did bite my Chinese assistant's thumb, with no bad effect.

"When annoyed, the tip of the tail is sometimes curled into a complete circle.

"One of these snakes became suddenly very active and vicious when attacked by a baby mongoose, striking at the mongoose and repeatedly driving it away. Thereupon it struck at any object brought near and vibrated its tail.

"These snakes are much feared by the Chinese." (C. H. P.)

***Holarchus formosanus hainanensis* (Böttger)**

Simotes hainanensis BÖTTGER, 1894, Ber. Senck. Ges., 1894, p. 133, Pl. III, fig. 2.

Simotes formosanus BÖTTGER, 1898, 'Kat. Rept. Mus. Senck.,' II, p. 73.

Holarchus formosanus STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 354 (in part).

Holarchus formosanus hainanensis BARBOUR, 1909, Proc. New England Zool. Club, IV, p. 70.

Eight specimens of this *Holarchus* were collected, A. M. N. H. Nos. 27796-27803.

One specimen has seven upper labials on each side, the 3d and 4th entering the eye, the rest have eight, with the 4th and 5th entering the eye. The lower labials are 8-9 in two specimens, 9-9 in six. There are invariably two preoculars and two postoculars. Two anterior temporals occur twice, one is normal; one temporal in the second row occurs once, two fifteen times, and three twice.

The dorsal scale count is slightly different in the two sexes; in the three female specimens it is 19-17, in one male 19-17, in four 19-17-15.

The largest male specimen measures 723 mm., the largest female 481 mm.

Summary of Ventrals, Caudals and Proportionate Tail-Length

| | SEX | No. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 5 | 165-171 | 168 |
| | ♀ | 3 | 175-178 | 177 |
| Caudals | ♂ | 5 | 54- 59 | 56 |
| | ♀ | 3 | 50- 51 | 50 |
| Tail/Total Length | ♂ | 5 | .18-.19 | .19 |
| | ♀ | 3 | .16-.17 | .16 |

Small specimens have a much more sharply defined pattern.

Barbour, 1909, p. 70, retains the name *hainanensis* as a subspecies of *formosanus*, chiefly on the basis of color differences between Formosan and Hainan specimens. There seems to be a considerable difference in the

average number of ventrals in specimens from the two islands, the average for eight specimens from Formosa (of both sexes) being 164.4, and of the twelve specimens now known from Hainan, 170.3, the respective extremes being 161-172 and 165-178. The contact of the parietal with the lower postocular, which Stejneger records as the usual condition in *formosanus*, does not occur in the specimens examined by me, nor is the exceptional upper anterior temporal to be thought of as cut off from the parietal.

The specimen recorded by Boulenger from Swatow, with 173 ventrals, suggests that it is the Hainan form rather than the Formosan which is found on the mainland.

***Enhydris plumbea* (Boie)**

Homalopsis plumbea BOIE, 1827, Isis, p. 550.

Hypsirhina plumbea BETTGER, 1888, Ber. Offenbacher Ver. Naturk., XXVI-XXVIII, p. 83; 1894, Ber. Senck. Ges., p. 134. BOULENGER, 1896, 'Cat. Snakes Brit. Mus.,' III, p. 5. BETTGER, 1898, 'Kat. Rept. Mus. Senck.,' II, p. 87.

Enhydris plumbea STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 300, Figs. 260-262. BARBOUR, 1909, Proc. New England Zoöl. Club, IV, p. 68. SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 203.

One hundred and twelve specimens of this common form, A. M. N. H. Nos. 27997-28107, 28045a, were collected.

The upper labials are eight in one hundred and ten specimens, 7-8 in one, and 8-9 in one. The lower labials range from nine to eleven, but one hundred and five specimens have ten on both sides. The preocular is usually single, two preoculars occurring twenty-seven times. The postoculars are even more constantly two in number, a single postocular occurring only seven times. A single anterior temporal is invariable, and in the second row, two are present in all but five counts, in each case on only one side of a specimen.

The dorsal scale rows vary from 20-16 to 19-15, the counts distributed as follows:

| COUNT | NO. OF SPECIMENS | |
|-------------|------------------|----|
| | ♂ | ♀ |
| 20-19-17-16 | 1 | |
| 19-17 | 39 | 50 |
| 19-17-16 | 4 | 2 |
| 19-17-15 | 13 | 3 |

Summary of Ventrals, Caudals, and Proportionate Tail-Length

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 57 | 125-136 | .129 |
| | ♀ | 55 | 123-132 | .128 |
| Caudals | ♂ | 53 | 36- 42 | .39 |
| | ♀ | 54 | 31- 36 | .34 |
| Tail/Total Length | ♂ | 53 | .13-.15 | .14 |
| | ♀ | 54 | .11-.14 | .12 |

Three stomachs contained the remains of a *Rana* sp., and two remains of *Microhyla*, the great majority of stomachs being empty.

A number of females contained undeveloped eggs, the number of enlarged ones ranging from four to eleven. One specimen contained four eggs (about 10×12 mm.), each with a small embryo.

"The common, gray water-snake bites viciously when caught with a noose, biting the stick and finally biting itself. When released in grass, it crawls slowly close to the ground, where it is well hidden."

***Enhydryis chinensis* (Gray)**

Hypsirhina chinensis GRAY, 1842, 'Zool. Misc.,' p. 73. BÖTTGER, 1888, Ber. Offenbacher Ver. Naturk., XXVI-XXVIII, p. 82; 1894, Ber. Senck. Ges., p. 134. BOULENGER, 1896, 'Cat. Snakes Brit. Mus.,' III, p. 8, Pl. 1, fig. 2. BÖTTGER, 1898, 'Kat. Rept. Mus. Senck.,' II, p. 88.

Enhydryis chinensis SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 203.

Forty-six specimens of this species, A. M. N. H. Nos. 27951-27996, were collected at Nodoa.

Like *Enhydryis plumbea*, this species is a stable one in all of its characters. Eight is the normal number of upper labials, 8-9 occurring twice and 9-9 once. Ten is the usual number of lower labials, 9-10 occurring in four specimens, and 10-11 in one. The only variation from a single preocular occurs on one side of the one specimen, which has two, and two postoculars are equally constant, a single one on one side of one specimen being the only exception. The temporals are invariably 1-2 on each side. A single specimen has two internasals. The dorsal scale count varies from 25-21 to 23-17, seventeen specimens having a dorsal scale formula of 25-23-21-19, and seventeen 23-21-19. There is a very slight tendency to higher numbers of dorsal scale rows in the females.

The range in ventral scales is somewhat lower than that given by Boulenger (see below), which is accounted for in part by his having only one female specimen, although Böttger's account (1888, p. 82) of fifteen specimens from Canton also shows a higher ventral and subcaudal count.

The largest male specimen measures 516 mm.; the largest female, 567 mm.

Summary of Ventrals, Caudals and Proportionate Tail-Length

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 26 | 135-147 | 143.5 |
| | ♀ | 20 | 134-141 | 137.6 |
| Caudals | ♂ | 26 | 40- 52 | 48. |
| | ♀ | 19 | 35- 43 | 39.5 |
| Tail/Total Length | ♂ | 26 | .15-.18 | .16 |
| | ♀ | 19 | .12-.14 | .13 |

The stomachs of two specimens contained remains of fish, and one of these stomachs also contained a large mass of parasitic worms.

"When picked up suddenly with a pair of forceps, this snake makes wild efforts to bite, waving its open jaws about and sometimes biting itself. When teased in a box, it would actually spring about, jumping clear of the bottom and advancing as much as a foot at each jump. After a few wild efforts it would subside and assume a defensive posture striking viciously at any object brought near. At such times the body is flattened. On a smooth floor it progresses rapidly with a series of crawling "leaps," the body being apparently raised clear of the floor with every spasmodic motion.

"A large female was kept in a water-jar and the frequency of respirations observed. If given half a chance these snakes make for water, and they lie contentedly at the bottom, nearly motionless, if placed in a water jar. Seven intervals between respirations varied from ten to fifteen minutes, averaging between thirteen and fourteen minutes. Respiration occupied from one to five minutes, only the tip of the snout being exposed.

"A large female, taken July 30th, contained six fully developed young, of which the largest measured 157 mm. in length." (C. H. P.)

***Boiga multimaculata* (Boie)**

Dipsas multimaculata BOIE, 1827, Isis, p. 549.

Dipsadomorphus multimaculatus BOULENGER, 1896, 'Cat. Snakes Brit. Mus.,' III, p. 63.

Boiga multimaculata BARBOUR, 1909, Proc. New England Zool. Club, IV, p. 72.

Boiga multimaculata SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 203.

This species is represented by twenty-three specimens A. M. N. H. Nos. 27844-27866.

The upper labials are regularly eight, seven appearing once and nine four times. The lower labials are regularly eleven, ten occurring twice

and twelve three times. The preoculars are two in two specimens, one in the rest, the postoculars normally two, with three appearing twice. The number of temporals in the first row is one to three, one occurring nine times, two thirty-two times, and three once; the second row varies from two to four, two in fifteen counts, three in twenty-seven, and four in two.

The dorsal scales differ slightly in the sexes, as follows:

| | | |
|-------------|------|------|
| 19-17-15 | ♂, 3 | ♀, 8 |
| 19-17-15-13 | ♂, 9 | ♀, 3 |

The largest male measures 836 mm., the largest female 834 mm.

Summary of Ventrals, Caudals and Proportionate Tail-Length

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 12 | 200-213 | 209 |
| | ♀ | 11 | 207-221 | 215 |
| Caudals | ♂ | 12 | 82- 98 | 92 |
| | ♀ | 10 | 80- 97 | 89 |
| Tail/Total Length | ♂ | 12 | .20-.22 | .21 |
| | ♀ | 10 | .19-.22 | .20 |

Three specimens had bird remains in their stomachs (one a *Motacilla* sp.), and one a lizard, *Calotes versicolor*.

This species was recorded from Hainan by Barbour, but omitted by both Vogt and Mell from their Hainan lists.

"The numbers of this snake brought in show that it is fairly abundant about Nodda. Two specimens were taken in the mission compound. I believe its habitat to be thick bushes and brush. The Chinese say that it is fond of bird's eggs and birds. Two specimens brought in disgorged bird remains.

"When annoyed, the 'Blotched Snake' assumes a defensive posture with the anterior part of the body thrown into several symmetrical S-shaped loops, with the neck strongly compressed and the head expanded at the rear. The tip of the tail may be strongly vibrated, producing a distinct noise among dry leaves. It strikes viciously and in a very business-like manner. The range of the stroke in a twenty-eight inch specimen was about twelve inches.

"One of these snakes was bitten several times by a three and one-half foot krait, without visible effect." (C. H. P.)

***Psammodynastes pulverulentus* (Boie)**

Psammophis pulverulenta BOIE, 1827, Isis, p. 547.

Psammodynastes pulverulentus GÜNTHER, 1858, 'Cat. Colubrine Snakes Brit. Mus.,' p. 140. BOULENGER, 1896, 'Cat. Snakes Brit. Mus.,' III, p. 172. STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 383, Figs. 317-319. BARBOUR, 1912, Mem. Mus. Comp. Zoöl., XLIV, p. 127.

Psammodynastes pulverulentis STANLEY, 1914, Journ. N. China Br. Roy. Asiatic Soc., XLV, p. 29.

Seven specimens of this form are in the present collection from Hainan, A. M. N. H. Nos. 27781-27787.

In this series the dorsal scales are uniformly 17-15. The ventrals, in six male specimens, range from 157-167, average 162, and are 171 in the single female. The caudals, in the males, range from 61 to 70, average 64.5, 59 in the female. The upper labials are invariably eight, the lower labials eight except for the occurrence of seven on one side in one specimen. The preoculars are two eleven times, one three times. The postoculars are invariably two. The first temporals are uniformly two, the second two with an exceptional three. The tail-length varies from .21 to .24 of the total in males, .18 in the female specimen.

The largest male measures 506 mm., the single female 380 mm.

One specimen represents the dark brown phase of this species, the rest belong to the more common gray form.

Barbour's record of this species from Hainan was missed by both Vogt and Mell in their lists of species recorded from Hainan. Hainan specimens are also mentioned by Stanley. Stejneger's prediction that this species might be expected on the Chinese mainland has been abundantly justified by the records from Fukien (Stanley) and Kwangtung (Mell).

"Under this head I seem to have either two species or two varieties, a dark and a light. The dark form is extremely rare, while the light is not common.

"This viper-like snake was brought in about the first of June by a little boy. The snake was tied along a stick but it was undaunted and at the slightest annoyance it opened its mouth and showed its little fang sheaths, biting viciously anything put in its jaw. It proved to be very active. When I put it out on the porch it started away, progressing by means of a series of peculiar half leaps. The body was drawn up and then extended vigorously in such a way that the snake appeared to be jumping. It moved rapidly across the smooth boards, an unusual feat for a snake. I have never seen a snake come nearer to actual jumping than this little specimen. While controlling the snake's direction with the point of

an umbrella, I noticed that the snake tried to crawl up the umbrella. It climbed with facility, and has thoroughly mastered the art of climbing a smooth vertical stick by holding itself in place with one tight coil while freely working the rest of its body. When put in a small tree it immediately climbed up and showed itself most expert in sliding along small branches. Its ability to project its head, unsupported, upward, and reach for a distant twig, is notable. When put on the tip of a drooping limb it went straight up, when it might easily have dropped to the soft grass only a foot below. After being released, its viciousness did not appear so pronounced. It became more interested in escaping than in fighting. However, I did not dare test its good nature with anything but a stick, and so expert a climber could not be expected to be afraid of a stick. Its color is protective only in that it matches branches or dead leaves.

"A light-colored specimen, brought in later, apparently did not want to climb. This may have been only an individual difference." (C. H. P.)

***Naja naja atra* (Cantor)**

Naja atra CANTOR, 1842, Ann. Nat. Hist., IX, p. 482.

Naja tripudians BÆTTGER, 1888, Ber. Offenbacher Ver. Naturk., XXVI-XXVIII, p. 85; 1894, Ber. Senck. Ges., p. 134.

Naia tripudians var. *fasciata* BOULENGER, 1896, 'Cat. Snakes Brit. Mus.,' III, p. 383.

Naja tripudians var. *fasciata* BÆTTGER, 1898, 'Kat. Rept. Mus. Senck.,' II, p. 121.

Naja naja atra STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 394. BARBOUR, 1912, Mem. Mus. Comp. Zoöl., XLIV, p. 136.

Naia naia atra BARBOUR, 1909, Proc. New England Zoöl. Soc., IV, p. 72.

The common cobra of southern China is represented by thirteen specimens, A. M. N. H. Nos. 27831-27843.

This series corroborates Stejneger's view of the characters of this subspecies. The upper labials are normally seven, with eight on one side in a single specimen. The lower labials are nine with a single exceptional eight. There is invariably a single preocular, and three postoculars in all except one case, which has two. The anterior temporals are always two, the second row varying from two to four, usually three.

The scales at mid-body are in twenty-one rows in twelve specimens, nineteen in the remaining one. On the neck the scale rows are twenty-five in three specimens, twenty-seven in six, and twenty-nine in four.

The largest male measures 1488 mm., the largest female 1473 mm.

Summary of Ventrals, Caudals and Proportionate Tail-Length

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------|-------|---------------------|----------|---------|
| Ventrals | ♂ | 8 | 164-172 | 168 |
| | ♀ | 5 | 169-177 | 173 |
| Caudals | ♂ | 7 | 41- 51 | 47 |
| | ♀ | 5 | 39- 47 | 45 |
| Ventrals+Caudals | ♂ + ♀ | 12 | 208-223 | 216 |
| Tail/Total Length | ♂ | 4 | .14-.17 | .16 |
| | ♀ | 3 | .14 | .14 |

The coloration of these series is variable upon a rather distinct and striking fundamental plan. The venter is dark, light on the chin and throat, and the subcaudals light with dark outlines. There is a broad black crossband on the throat just posterior to the position of the hood-mark, which covers five or six ventrals and meets the dark dorsal color. Just anterior to the hood-mark, on the throat, is a second transverse black band, which may be poorly defined, or absent. In the latter case, however, its ends, which do not reach the dark dorsal color, remain as a pair of black latero-ventral spots. The general dorsal color is black, with six to eight light crossbands on the posterior half, each consisting of a pair of narrow light lines, with several more irregular transverse markings on the tail. The hood is marked with a round, heart-shaped, or diamond-shaped light area, which may be joined to the light color beneath the neck, and which encloses a large central black spot, with a smaller one on each side of it.

The pairs of light lines may unite laterally; they may alternate with single transverse light lines; and there may be single transverse lines on the anterior half of the body. No. 27837 exhibits this pattern in its extreme development, with five distinct, single, transverse light lines on the anterior half of the body, and eight pairs of lines on the posterior half, with irregular transverse markings on the tail. This is not at all a juvenile pattern, as it is least marked on a small specimen, No. 27834, which has only a few single, short, light transverse markings on the posterior part of the back. The figure of a Sumatran cobra given by Ditmars (1910, 'Reptiles of the World,' Pl. LXVII), shows the transverse light markings in pairs anteriorly, with a hood marking like that of the Hainan series.

"The cobra is common, as is shown by the number of specimens collected. Many more could have been secured if we had taken dead specimens. The Chinese are much afraid of these deadly snakes. It has been a surprise to me that they can be so easily managed. I do not

consider the cobra to be aggressive. None of our specimens showed any inclination to attack a man. Instead of showing fight when teased, they constantly attempt to escape, and only adopt a defensive attitude as the last resort.

"I have not seen a cobra outside. One was caught in a rat-trap, and one was found in the Mission compound.

"Small cobras are especially swift and agile, and older ones are alert and active. When they bite, they chew away until certain that their fangs have reached their mark. They quickly learn that it is useless to bite wood. When enraged, they will sometimes bite themselves.

"The behavior of cobra and mongoose was tested twice, once with a five-foot snake and a small mongoose and once with a three-foot cobra and a large mongoose. Both cobra and mongoose gave every evidence of regarding their opponents as dangerous enemies and, when placed together in a room each concentrated its attention on the other. Contrary to popular ideas of the mongoose's mode of attack, each of these specimens attacked the cobra at the moment when the latter struck, biting at the snake's open mouth so that snake and mongoose jaws became repeatedly interlocked. The snake's stroke was avoided, usually with a single motion of the head, except when it was caught in the open mouth of the mongoose. It is difficult to understand these tactics, for the snakes could scarcely fail to inoculate their enemy with poison. The small mongoose failed to kill its cobra, and died itself on the second day after the fight, but with no evident effects from the poison (it was apparently weak when brought to us). The larger mongoose killed its enemy and showed no ill effects from the encounter. Neither mongoose made the slightest attempt to attack the cobra from behind. The larger mongoose repeatedly approached the cobra and lay down on its side, just beyond reach of the cobra's stroke, keeping its eyes fixed on snake, and raising its head to keep it in view—a most peculiar and inexplicable performance." (C.H. P.)

***Bungarus multicinctus* Blyth**

Bungarus multicinctus BLYTH, 1861, Journ. Asiatic Soc. Bengal, XXIX, p. 98. STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 397, Figs. 325-327.

Bungarus candidus var. *multicinctus* BOULENGER, 1896, 'Cat. Snakes Brit. Mus.,' III, p. 369.

A. M. N. H. Nos. 27789-27795, seven specimens, represent this species in the present collection.

Both upper and lower labials are uniformly seven. The preocular is single and there are two postoculars in all. The anterior temporal is

invariably single, and those of the second row are usually two, exceptionally one or three. The dorsal scales are uniformly fifteen throughout the length except in one specimen, which has seventeen rows on the neck. The ventrals in the single male are 211, the subcaudals 48. In the six females, ventrals and subcaudals average 212 and 50, respectively, ranging from 207 to 214 and from 47 to 53. The tail-length is .12 of the total in the male, and ranges from .12 to .14 of the total in the six females.

The male specimen measures 1333 mm., the largest female 1354 mm.

The number of light crossbands on the back varies from 32 to 40, and those on the tail range from 9 to 15. The scales in the light bands are dotted with brown in the larger specimens.

"I found a specimen of the krait while hunting tree frogs at night, in the small banana grove just back of Mr. Leverett's house. It made no effort to escape when the light was flashed on it. Dr. Salsbury tells me of another specimen having been killed on a tennis court at night some time ago.

"All of the specimens observed seemed very inoffensive. When teased with a stick, they coil with the body somewhat flattened and with the head concealed in the center of the coil. If the teasing is then continued, they make spasmodic jerks, throwing the body around, but making no effective effort to escape. In no case did these snakes strike. They occasionally bit the stick with which they were teased, and two specimens confined together bit each other. Two of the specimens could not be induced to bite at all.

"This snake is much feared by the Chinese, which is perhaps why we have been able to secure only a few specimens." (C. H. P.)

***Calliophis macclellandii* (Reinhardt)**

Elaps macclellandii REINHARDT, 1844, Calcutta Journ. Nat. Hist., IV, p. 532.

Calliophis macclellandii GÜNTHER, 1864, 'Rept. Brit. India,' p. 349.

Calliophis macclellandii STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 391, Figs. 323-324.

Five specimens. A. M. N. H. Nos. 27776-27780, form the first record of this species from Hainan.

Upper labials six in one case, seven in the rest; lower labials uniformly six; preoculars one, postoculars two; temporals 1-1 on each side; dorsal scales in thirteen rows. Variation in tail-length, ventrals and caudals does not appear to be correlated with sex. Ventrals range from 205 to 216, average 210; subcaudals from 36 to 38; tail-length from .11 to .12 of the total.

The largest male measures 460 mm., the largest female 419 mm.

The color pattern of No. 27777 may be described as follows: reddish brown above, each scale with a darker tip; back crossed at regular intervals by short, narrow, straight black lines, twenty-six in number, reaching the third or fourth scale row; venter yellowish cream color, with fifty-three black blotches, which do not reach the ends of the ventrals, each alternate mark opposite a dorsal line; these cover one or two ventrals, and are frequently offset on the median line; four dorsal black lines on the tail and nine black markings beneath; a nuchal collar, and anterior part of head black, with a vivid yellow band which covers the sixth and seventh labials, the temporals, and the parietals; anterior labials and lower half of rostral lighter. No. 27779 has the dorsal transverse markings broader (half or two-thirds the length of a scale), slightly shorter from side to side, and outlined with light. In No. 27776 the dorsal marks are reduced to spots, usually on alternate sides of the midline, and the ventral blotches are enlarged, covering from two to five ventrals, and only forty-six in number. This apparently is the color-variety *C. m. gori* Wall, of Assam (Wall, 1918, Journ. Bombay Nat. Hist. Soc., XXV, p. 631).

"Dr. Salsbury brought a specimen of the 'Hainan coral snake' from Kachek. The Chinese say that this species is nocturnal. One specimen would only coil around and around, if annoyed, and keep its head in the center of the regular coils. It could not be induced to strike or assume an offensive attitude, nor could it be made to bite. It crawls in a straight line with a smooth gliding motion." (C. H. P.)

***Amblycephalus moellendorffii* Boettger**

Pareas moellendorffii BÖETTGER, 1885, Ber. Offenbacher Ver. Naturk., XXIV-XXV, p. 125; 1888, idem, XXVI-XXVIII, p. 84, Pl. II, fig. 1. COPE, 1895, Proc. Acad. Nat. Sci. Phila., (1894), p. 424.

Amblycephalus moellendorffii BOULENGER, 1896, 'Cat. Snakes Brit. Mus.,' III, p. 443. SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 204.

Seven specimens, A. M. N. H. Nos. 27769-27775, in the present collection.

The upper labials are seven, six on one side of one specimen, the lower labials seven, eight on one side of one specimen. One preocular and one postocular in all. Temporals 2-2 to 2-4. Three pairs of chin shields in six specimens, four in one. The dorsal scales are in fifteen rows throughout the body. The ventrals range from 139 to 142 in five males, average 140, and from 147 to 150 in the two females. The caudals in the male specimens range from 52 to 58, average 54, in females 41 to 43. The tail-length in males ranges from .22 to .24 of the total, average .23, in the two females it is only .15 and .16.

The coloration agrees with descriptions and with Bœttger's figure.

The fact that this snake is fairly abundant in Hainan, together with Boulenger's record from Hongkong, disposes of the supposition of Mell and Vogt that this species is replaced in Kwangtung by *A. kuangtungensis*.

Crotalidæ

Trimeresurus gramineus (Shaw)

Coluber gramineus SHAW, 1802, 'Gen. Zool.,' III, Pt. 2, p. 420.

Trimeresurus gramineus GÜNTHER, 1864, 'Rept. Brit. India,' p. 385. BœTTGER, 1894, Ber. Senck. Ges., p. 135. STANLEY, 1914, Journ. N. China Br. Roy. Asiatic Soc., XLV, p. 31 (part). SMITH, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 205.

Trimeresurus erythrurus BœTTGER, 1888, Ber. Offenbacher Ver. Naturk., XXVI-XXVIII, p. 91.

Lachesis gramineus BOULENGER, 1896, 'Cat. Snakes Brit. Mus.,' III, p. 554 (part). BœTTGER, 1898, 'Kat. Rept. Mus. Senck.,' II, p. 139 (part).

Trimeresurus albolabris GRAY, 1842, 'Zool. Misc.,' p. 48.

Trimeresurus gramineus albolabris MELL, 1922, Arch. Naturg., LXXXVIII, Abt. A, Heft 10, p. 126.

Forty-one specimens of this species were brought to Mr. Pope at Nodda, A. M. N. H. Nos. 27910-27950.

In this series, the preoculars are two or three, according as the scale bordering the loreal pit below enters or is very narrowly excluded from the eye. There is a narrow, curved subocular, and between this and the supraocular there are usually two small postoculars, occasionally three.

The internasals are rather large, in contact in thirty-five specimens, and in the remaining six they are separated by a single scale, a character which distinguishes this form from the closely allied *Trimeresurus stejnegeri*¹ of Fukien and Formosa.

The range of variation of the dorsal scale rows from neck to anus may be summarized as follows:

| DORSAL SCALE ROWS | NO. OF SPECIMENS |
|----------------------|---------------------|
| 27-15 | 1 |
| 25-15 | 11 |
| 23-15 | 28 |
| 21-15 | 1 |

¹Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 4.

Summary of Scale Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-----------------------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 21 | 153-162 | 158 |
| | ♀ | 20 | 158-167 | 161 |
| Caudals | ♂ | 21 | 65- 73 | 69.5 |
| | ♀ | 19 | 52- 60 | 56 |
| Scales Between Supraoculars | ♂ | 21 | 8- 13 | 11 |
| | ♀ | 20 | 9- 13 | 11 |
| Upper Labials | ♂ | 21 | 10- 12 | 10.4 |
| | ♀ | 20 | 10- 12 | 11.1 |
| Lower Labials | ♂ | 21 | 11- 14 | 12.2 |
| | ♀ | 20 | 12- 16 | 13.0 |
| Total Length, mm. | ♂ | 21 | 313-626 | 498 |
| | ♀ | 19 | 335-945 | 703 |
| Tail-Length+Total Length | ♂ | 21 | .18-.22 | .20 |
| | ♀ | 19 | .14-.18 | .16 |

Seven stomachs contained the remains of mammals, three contained frogs, and one a lizard (*Calotes versicolor*).

Mell, 1922, p. 126, on the basis of extensive field observation, found the Chinese pit vipers of the *gramineus* group evidently divisible into two forms, a northern, mountain form, for which he retained the name *gramineus*, and a southern, plains form, for which he suggested the use of the name *Trimeresurus gramineus albolabris* Gray. It is evident from his description and from the range suggested by him, that it is the latter form which is common in Hainan. I find that specimens from Formosa, Fukien, and Yunnan are readily distinguishable from the Hainan form, and evidently represent Mell's *gramineus gramineus*. The examination of specimens of *gramineus* from Indo-China, Siam, Java, and India, however, proves that it is the southern form which ranges to Hainan and Canton, and that *T. albolabris* is therefore a strict synonym of *gramineus*. I have proposed names for the allied Yunnan and central Chinese species in a former paper, and hope to return in the future to a more extended discussion of their relations.

"This viper must be rated as common. At one time it was brought in often, about one specimen every other day. I have never found one myself, in spite of the fact that I was out collecting every day during the time it was being brought in so often. Perhaps it stays in the green, and perhaps it was brought in more frequently in the winter because of the scarcity of green cover. It was rarely brought in later in the season, though we continued to advertise for it.

"One of these vipers was hanging on the outside of a basket containing a python, and I unconsciously put it (the viper) in my lap. It made no attempt to strike. A viper that was quite exhausted after disgorging its meal soon recovered its activity. I found that it would snap as well as strike. When the end of a stick was placed just back of its head, its jaws snapped on it with lightning speed, the fangs obviously being brought into action. It repeated this performance several times when the stick was brought near it. When put out and worried with a piece of cloth, it still snapped viciously, but would wait until the object was quite near. It assumes the usual S shape in preparing to strike.

"A half-grown specimen disgorged a small rat; an eighteen inch specimen disgorged a lizard, probably *Calotes*; a fifteen-inch specimen disgorged two half-grown rats. A thirty-three-inch specimen had swallowed a large rat. Its diameter at the neck was half an inch, and at the place where the rat was contained, one and three-fourths inches." (C. H. P.)

LIST OF THE SPECIES OF REPTILES KNOWN FROM HAINAN

TURTLES

1. *Platysternon megacephalum* (Gray)
2. *Ocadia sinensis* (Gray)
3. *Clemmys bealii* (Gray)
4. *Clemmys mutica* (Cantor)
5. *Cyclemys trifasciata* (Bell)
6. *Pyxidea mouhotii* (Gray)
7. *Amyda sinensis* (Wiegmann)
8. *Amyda steindachneri* (Siebenrock)
9. *Pelochelys cantorii* (Gray)

No endemic species of turtle is known from Hainan. Mell (1922, p. 108) lists *Testudo emys* as recorded from this island, but on what authority I am unable to discover. It seems possible that he may have misinterpreted Siebenrock's note (1906, p. 583), to which he refers. Smith (1923a, p. 196) also ascribes five species of turtles to Hainan, apparently following Mell. He indicates a species of turtle (not specified) as confined to Hainan, but this is doubtless *Clemmys schmackeri*, whose identity with *Clemmys mutica* of the Chinese mainland can scarcely be doubted. As in other groups of reptiles, it seems evident that the turtle fauna of Hainan is by no means exhausted with the present list.

LIZARDS

1. *Goniurosaurus lichtenfelderi* (Mocquard)
2. *Hemidactylus frenatus* Duméril and Bibron
3. *Hemidactylus garnotii* Duméril and Bibron
4. *Peropus mutilatus* Wiegmann
5. *Gekko similignum* M. A. Smith
6. *Draco whiteheadi* Boulenger
7. *Calotes versicolor* (Daudin)
8. *Acanthosaura hainanensis* Boulenger
9. *Leiolepis belli* (Gray)
10. *Varanus salvator* (Laurenti)
11. *Takydromus sexlineatus meridionalis* (Günther)
12. *Mabuya longicaudata* (Hallowell)
13. *Mabuya multifasciata* (Kuhl)
14. *Sphenomorphus indicus* (Gray)
15. *Sphenomorphus leveretti*, new species
16. *Leiolopisma reevesii* (Gray)
17. *Lygosaurus salsburyi*, new species
18. *Eumeces chinensis* (Gray)
19. *Eumeces quadrilineatus* (Blyth)
20. *Tropidophorus hainanus* M. A. Smith

Besides the two new species, the two named by Boulenger, and the two recently discovered by Dr. Malcolm A. Smith are known only from Hainan. I am convinced that *Goniurosaurus hainanensis* Barbour and *Eublepharis lichtenfelderi* Mocquard must be united. The differences discoverable in the original descriptions relate to the sex of the specimens examined or are due to different methods of description. The type locality of *E. lichtenfelderi* is the Norway Islands, across the Gulf of Tonkin from Hainan. Mr. F. Angel, of the Museum d'Histoire Naturelle in Paris, to whom I have been indebted for similar favors in the past, has kindly examined this type and has supplied me with an excellent photograph (Plate XXVII), and a figure of the scales surrounding the nostril (Text Fig. 17). The photograph, compared with Barbour's figure of *hainanensis*, proves their identity in habitus and color pattern, and the figure shows the nasal scales, which are differently described, to be in reality the same. Through the courtesy of Dr. Barbour, I was able to examine the type of *G. hainanensis* at the Museum of Comparative Zoölogy.



Fig. 17. Tip of snout of *Eublepharis lichtenfelderi* (type).

To show arrangement of the nasals (figured through the courtesy of M. F. Angel, Museum d'Histoire Naturelle, Paris).

SNAKES

1. *Typhlops braminus* (Daudin)
2. *Python bivittatus* Schlegel
- *3. *Sibynophis hainanensis*, new species
4. *Natrix æquifasciata* Barbour¹
- *5. *Natrix andrewsi*, new species
6. *Natrix chrysarga* (Schlegel)
7. *Natrix percarinata* (Boulenger)
8. *Natrix piscator* (Schneider)
- *9. *Natrix popei*, new species
10. *Natrix stolata* (Linné)
11. *Natrix subminiata* (Schlegel)
12. *Trimerodytes balteatus* Cope
13. *Pseudozenodon melli* Vogt
- *14. *Achalinus meridianus* M. A. Smith
15. *Lycodon subcinctus* Boie
16. *Ptyas korros* (Schlegel)
17. *Ptyas mucosus* (Linné)
18. *Elaphe porphyracea* (Cantor)
19. *Elaphe tæniura vaillanti* (Mocquard)
20. *Ahaetulla boiga* (Lacépède)
- *21. *Holarchus formosanus hainanensis* (Bættger)
- *22. *Holarchus nesiotis* Barbour
23. *Holarchus violaceus* (Cantor)
24. *Enhydryis bennetti* (Gray)
25. *Enhydryis chinensis* (Gray)
26. *Enhydryis plumbea* (Boie)
27. *Boiga multimaculata* (Boie)
28. *Psammodynastes pulverulentus* (Boie)
29. *Thalassophina viperina* (Schmidt)
30. *Hydrophis cyanocinctus* (Daudin)
31. *Microcephalophis gracilis* (Shaw)
32. *Naja naja atra* (Cantor)
33. *Bungarus multicinctus* Blyth
34. *Calliophis maclellandii* (Reinhardt)
- *35. *Amblycephalus carinatus hainanus* M. A. Smith
36. *Amblycephalus moellendorffii* (Bættger)
37. *Trimeresurus gramineus* (Shaw)

The seven species marked with an asterisk in the above list are known only from Hainan. As the snake fauna of the more northern island of Formosa consists of about fifty species, it is evident that numerous additions to the above list may still be expected.

The known reptile fauna of Hainan is now brought up to a total of sixty-six species, exclusive of marine turtles.

¹This species is now known from the Chinese mainland.

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PLATE XXVII

Dorsal view of type of *Eublepharis lichtenfelderi* (figured through the courtesy of M. F. Angel, Museum d'Histoire Naturelle de Paris).



Article IV.—NOTES ON CHINESE REPTILES¹BY KARL PATTERSON SCHMIDT²

With Extracts from the Field Notes of Clifford H. Pope

PLATES XXVIII TO XXX, TEXT FIGURES 1 TO 22

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INTRODUCTION

The total collection of reptiles from the Chinese mainland, made by the several expeditions of The American Museum of Natural History, amounts to 1487 specimens. The principal component collections come from the provinces of Fukien and Yunnan, collected by R. C. Andrews and Edmund Heller, 1916–1917; Fukien, H. R. Caldwell, 1916–1921; Szechwan, Walter Granger, 1921; Mongolia, R. C. Andrews, 1922; and Chihli, Shansi, and Anhwei, Clifford H. Pope, 1921–1922.

A number of specimens of Chinese reptiles in The American Museum of Natural History, received as a gift from Mr. J. W. Williams, College of Yale-in-China, Changsha, Hunan, and by purchase from Rev. John Graham, Yunnanfu, Yunnan, have also been examined. These and other minor sources add fifteen species and 116 specimens. The whole collection of mainland Chinese reptiles in the American Museum includes 104 species, distributed among the following families:

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 76.

²Of the Field Museum of Natural History.

| | NO. OF GENERA | NO. OF SPECIES | NO. OF SPECIMENS |
|----------------------------------|------------------|-------------------|---------------------|
| TESTUDINATA | | | |
| Testudinidae | 2 | 3 | 39 |
| Trionychidae | 1 | 1 | 54 |
| LORICATA | | | |
| Crocodylidae | 1 | 1 | 20 |
| SAURIA | | | |
| Gekkonidae | 3 | 6 | 144 |
| Agamidae | 4 | 10 | 216 |
| Anguidae | 1 | 2 | 4 |
| Lacertidae | 2 | 9 | 437 |
| Scincidae | 5 | 11 | 178 |
| SERPENTES | | | |
| Typhlopidae | 1 | 1 | 1 |
| Colubridae (<i>sens. lat.</i>) | 20 | 51 | 487 |
| Crotalidae | 2 | 9 | 73 |

The necessity for a rigid scrutinization and verification of locality records of Chinese reptiles is well shown by a small collection of snakes purchased by Mr. Pope at Wuhu, Anhwei, and a single specimen of the South Chinese *Sibynophis collaris* purchased at Hsing Lung Shan, Chihli. The Wuhu collection does not contain a single specimen of the local Anhwei fauna, but is composed of species otherwise known from Fukien, Kwangtung, and Szechwan. Mr. Pope notes that the locality records given by a Chinese vendor of such specimens will invariably be the most remote, on the theory of enhanced value, and are thus entirely untrustworthy.

Of the forty-nine species of reptiles collected by Mr. Pope in Hainan, which have already been reported upon, only thirteen are contained in the present collection, and these are forms found chiefly in southern Fukien. The faunal boundary of primary significance to Chinese herpetology seems to be the mountain ranges of northern Kwangtung and western Fukien. These are themselves important centers of evolution and differentiation, as well as highways of eastward migration from the Himalayan area.

The present studies are preliminary to a comprehensive report on the reptiles of China, to include the future as well as the existing collections of the Third Asiatic Expedition. I have accordingly no more than touched upon the highly interesting distributional problems which present themselves in this fauna. For the same reason I have omitted the synonymy of the species considered, except where quoted for a special purpose.

Through the courtesy of Dr. Thomas Barbour of the Museum of Comparative Zoology and of Dr. Leonhard Stejneger of the United

States National Museum, I have been able to examine Chinese specimens in their charge in connection with the collections here reported upon, and I have profited on frequent occasions by the advice of both.

My connection with the present report results from a cordial co-operative arrangement between The American Museum of Natural History and the Field Museum of Natural History, arranged at the instance of Mr. Roy Chapman Andrews, leader of the Third Asiatic Expedition. Mr. Clifford H. Pope, to whose efforts the collection of a large part of the material is due, has kindly permitted the incorporation of a part of his field notes, and I have discussed numerous questions with him in the course of the work.

LIST OF NEW FORMS AND TYPE LOCALITIES¹

| TURTLES | |
|--------------------------------------|--------------------------|
| <i>Geoclemys grangeri</i> | Yenchingkau, Szechwan. |
| LIZARDS | |
| <i>Calotes alticristatus</i> | Yunnanfu, Yunnan. |
| <i>Eremias barbouri</i> | Mai Tai Chao, Shansi. |
| <i>Leiolopisma monticola</i> | Likiang, Yunnan. |
| <i>Leiolopisma septentrionale</i> | Hsing Lung Shan, Chihli. |
| SNAKES | |
| <i>Natrix helleri</i> | Tengyueh, Yunnan. |
| <i>Natrix nivalis</i> | Likiang, Yunnan. |
| <i>Natrix septemlineata</i> | Tengyueh, Yunnan. |
| <i>Dinodon rufozonatum williamsi</i> | Changsha, Hunan. |
| <i>Elaphe bimaculata</i> | Ningkwo, Anhwei. |
| <i>Elaphe osborni</i> | Tengyueh, Yunnan. |
| <i>Elaphe porphyracea pulchra</i> | Yunnanfu, Yunnan. |
| <i>Gonyosoma caldwelli</i> | Yenping, Fukien. |
| <i>Boiga sinensis</i> | Fukien Province. |
| <i>Trimeresurus orientalis</i> | Shaowu, Fukien. |
| <i>Trimeresurus stejnegeri</i> | Shaowu, Fukien. |
| <i>Trimeresurus yunnanensis</i> | Tengyueh, Yunnan. |

ANNOTATED LIST OF SPECIES

TESTUDINATA

Clemmys mutica (Cantor)

Emys mutica CANTOR, 1842, Ann. Nat. Hist., IX, p. 482.

Damonia mutica BOULENGER, 1889, 'Cat. Chelon, Brit. Mus.,' p. 96.

Clemmys schmackeri BETTGER, 1894, Ber. Senck. Ges., p. 129, Pl. III, fig. 1.

Clemmys nigricans SIEBENROCK, 1903, Sitzber. Akad. Wiss. Wien (math.-natur.),

CXII, Abt. 1, p. 439.

¹Diagnoses of these species have appeared in Amer. Mus. Novitates, No. 157, February 13, 1925, and No. 175, May 28, 1925.

Clemmys mutica SIEBENROCK, 1910, Ann. Naturh. Hofmus. Wien, XXIII, p. 312, Pl. I-II.

The above synonymy supplies the key to the further bibliography of this species and presents the principal mutations in its name. It still appears as "*Damonia*" in Mell's list of Kwangtung species, but was not taken by him, unless it is included with the *Clemmys nigricans* of his report.

A single female specimen, A. M. N. H. No. 31065, was collected by Mr. Clifford H. Pope at Ningkwo, Anhwei Province, Sept.-Oct. 1921.

While this specimen presents some variations in general appearance from the Hainan series collected by Mr. Pope, there is no important difference discoverable. Ningpo and Ningkwo are the most northern records of this species, and a good series of it from that area is a desideratum.

The measurements of the present specimen are as follows:

| | |
|---------------------|---------|
| Length of Carapace | 137 mm. |
| Breadth of Carapace | 98 |
| Depth | 56 |
| Length of Plastron | 114 |
| Breadth of Plastron | 71 |

***Geoclemys reevesii* (Gray)**

Thirty-five specimens of this species are in the collection of The American Museum of Natural History. A. M. N. H. Nos. 17415 and 17417-17420 were collected at Changsha, Hunan, August 1920, by Mr. J. W. Williams; No. 23518 is from Yocow, Hunan, collected December 1921-March 1922, by Mr. Clifford H. Pope; and Nos. 31093-31120 are from Ningkwo, Anhwei Province, September-October 1921, collected by Clifford H. Pope.

Three specimens present the melanistic phase, which is known as var. *unicolor*, of this species; these have no trace of markings on head and neck, as well as a uniformly black shell. Other specimens, with a very dark shell, retain traces of the neck markings. It seems evident that this color variety is co-extensive in range with the parent species.

Measurements of ten specimens of the Ningkwo series are as follows:

| A. M. N. H. No. | SEX | LENGTH CARAPACE | BREADTH CARAPACE | DEPTH | LENGTH PLASTRON | BREADTH PLASTRON |
|--------------------|------|--------------------|---------------------|--------|--------------------|---------------------|
| 31093 | juv. | 39 mm. | 30 mm. | 19 mm. | 33 mm. | 25 mm. |
| 31095 | juv. | 52 | 42 | 25 | 45 | 33 |
| 31100 | ♂ | 63 | 46 | 29 | 53 | 38 |
| 31109 | ♀ | 74 | 55 | 34 | 68 | 47 |
| 31096 | ♂ | 85 | 60 | 37 | 74 | 50 |
| 31120 | ♂ | 94 | 65 | 44 | 79 | 54 |
| 31119 | ♀ | 104 | 68 | 46 | 89 | 57 |
| 31115 | ♀ | 117 | 81 | 55 | 109 | 71 |
| 31116 | ♀ | 131 | 87 | 57 | 116 | 72 |
| 31117 | ♀ | 154 | 100 | 72 | 133 | 87 |
| Average of 5 Juv. | | 47 | 38 | 24 | 42 | 31 |
| Average of 13 | ♂ | 75 | 53 | 34 | 64 | 44 |
| Average of 15 | ♀ | 103 | 72 | 47 | 92 | 61 |

"The three-ridged, hard-shelled turtle is never taken by the fishermen, who constantly catch the soft-shelled turtles. I have seen them dropping into the water from inclined logs on the bank." (C. H. P.)

***Geoclemys grangeri*, new species**

Figures 1 and 2

Geoclemmys reevesi VOGT, 1924, Zool. Anz., LX, p. 337 [?]. WERNER, 1924, Denkschr. Akad. Wiss. Wien (math.-natur.), XCIX, p. 40 [?].

TYPE.—A. M. N. H. No. 23481; ♂; Yenchingkao, Wanh sien, Szechwan, 1500 ft. alt.; November, 1921; Walter Granger.

DIAGNOSIS.—Differs from *Geoclemys reevesii* in having the axillary shield larger than the inguinal; the small occipital shields much smaller; and the spots of the plastral shields much smaller and more sharply defined. The gular suture is more than twice that of the humerals; the first marginal is the broadest; and the bridge is a little longer than the posterior lobe of the plastron.

DESCRIPTION OF TYPE.—Snout rather pointed, strongly projecting, vertical profile oblique; edges of jaws smooth, the upper without median notch or hook; head covered with a large smooth shield, behind which are very small scale-like areas on the skin, merging gradually into the rugose skin of the neck; carapace nearly uniform oval as seen from above, the lateral profile uniformly rounded, the greatest depth at about the middle of the shell; carapace with three well-defined keels; lateral marginals with turned up edges; first marginal broadest; plastron very slightly concave, strongly notched behind, the femorals projecting laterally; axillary shield larger than the inguinal; bridge a little longer than the posterior lobe of the plastron, (measured to the points of the anals).

Dorsal shields brown, lightest on the lateral keels, margined with dark lines which define the light lines of the sutures very sharply; a yellow spot on the edges of the five most posterior marginals on each side; plastron yellow, with a black spot on each shield, each nearly as long and about half as wide as the shield; a pair of lateral

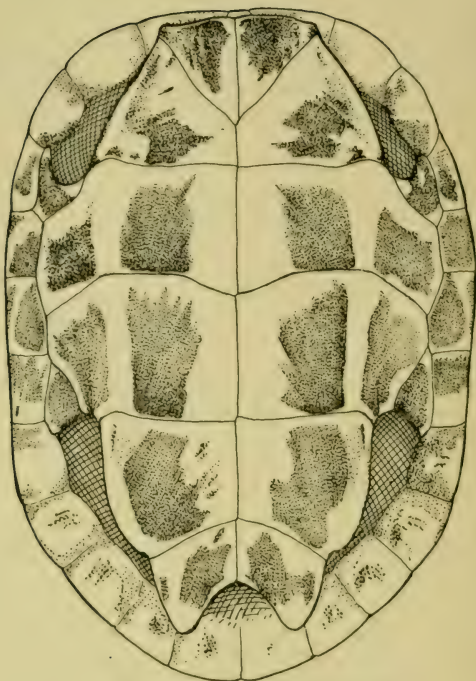


Fig. 1. *Geoclemys grangeri*, new species.
Plastron of type, natural size.

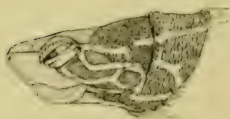


Fig. 2. *Geoclemys grangeri*, new species.
Head pattern of type, natural size.

spots on each bridge, one on each axillary and inguinal shield, and a diffuse spot on the lower parts of the lateral marginals.

Neck with a median, a dorsolateral, and two lateral light lines; spotted beneath; pattern of the head as in *reevesii*, its chief elements a stirrup-shaped mark on the chin, a sinuous line from the posterior corner of the eye over the ear to the lateroventral line on the neck, a more nearly horizontal line above this, and an irregular line a little behind the ear, from the dorsolateral line to the lateroventral; a faint line from the lower border of the eye to the ear, where it may end in a fork; limbs without markings.

The measurements of the shell and the plastral sutures are as follows:

| | |
|---------------------|---------|
| Length of Carapace | 108 mm. |
| Breadth of Carapace | 74 |
| Depth | 45 |
| Length of Plastron | 91 |
| Breadth of Plastron | 61 |
| Gular Suture | 18 |
| Humeral Suture | 6.5 |
| Pectoral Suture | 21 |
| Abdominal Suture | 20 |
| Femoral Suture | 16 |
| Anal Suture | 10 |

As the present form is unfortunately based on a single specimen, its status requires verification. Should it prove valid, the "*Geoclemmys reevesi*" recorded from Chengtu, Szechwan, by Vogt, should be referable to it, and possibly also the Yunnanfu specimen recorded by Werner.

Trionychidæ

Amyda tuberculata (Cantor)

Trionyx tuberculatus CANTOR, 1842, Ann. Mag. Nat. Hist., (1) IX, p. 482.

Amyda sinensis STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 524. BARBOUR, 1909, Proc. New England Zool. Club, IV, p. 77. STEJNEGER, 1910, Proc. U. S. Nation. Mus., XXXVIII, p. 114. WANDOLLECK, 1910, Zool. Anz. XXXV, p. 566, fig. 1-3. BARBOUR, 1912, Mem. Mus. Comp. Zool., XL, p. 135.

Trionyx sinensis (part) SIEBENROCK, 1907, Sitzber. Akad. Wiss. Wien (math.-natur.), CXVI, Abt. 1, p. 1768; 1909, Zool. Jahrb., Suppl., X, p. 601.

Amyda schlegelii STEJNEGER, 1907, Bull. U. S. Nation. Mus., No. 58, p. 526, fig. 407-409.

The status of the Chinese soft-shelled turtles of the allied forms which Boulenger unites as *Trionyx sinensis* has been a subject of discussion since Dr. Stejneger, in his 'Herpetology of Japan' suggested their separation into several distinct forms, as follows:

- | | |
|-------------------------|----------------------|
| 1.—A Japanese form | <i>A. japonica</i> |
| 2.—An Amur River form | <i>A. maackii</i> |
| 3.—A North Chinese form | <i>A. schlegelii</i> |
| 4.—A South Chinese form | <i>A. sinensis</i> |

This subdivision was proposed as a very tentative one, and it elicited criticism from Siebenrock and Wandolleck. Stejneger himself, in 1910, regards two specimens from Honan as indistinguishable from Japanese specimens. Siebenrock, in 1907, examined a series of fourteen specimens from the Chinese mainland, and compared them with Japanese, Formosan, and Hainan specimens, with reference only to the characters of the median keel and of the carapacial tubercles, which had been employed by Stejneger. It seems obvious that many more characters must be examined in detail before reaching a conclusion on this problem.

In the fifty-eight specimens before me, which are rather well distributed from Mongolia to Hainan, the variation in form of shell is bewildering, so much so that I am convinced that the solution of the problem rests with the accumulation of still more extensive series.

The Chinese specimens in the collection of The American Museum of Natural History are the following: A. M. N. H. No. 17416, Changsha, Hunan, August 1920, J. W. Williams; Nos. 23514-23517, 23519-23520, Yochow, Hunan, December 1921-March 1923, Clifford H. Pope; Nos. 21464-21468, Hsing Lung Shan, Eastern Tombs, Chihli, August 1st-14th, 1921, Clifford H. Pope; No. 31066, Peking, Chihli, (bought in market), 1921, Clifford H. Pope; No. 23480, Chun Chow, Szechwan December 1921, Walter Granger; Nos. 23484-23487, Fukien Province, H. R. Caldwell; No. 31518, Yenping, Fukien, 1921, H. R. Caldwell; Nos. 23482-23483, and 31067-31080, Ningkwo, Anhwei, September-October, 1921, Clifford H. Pope; No. 24719, Niantzekwan, Shansi, September 15 1922, Clifford H. Pope; Nos. 31081-31092, Chen Tzu, Taiyuan, Shansi, July-August, 1922, Clifford H. Pope; and Nos. 23914-23919, Paotowchen, Mongolia, May, 1922, Clifford H. Pope.

The numbers of specimens in geographically comparable series are as follows:

| | |
|----------|----|
| Chihli | 6 |
| Shansi | 13 |
| Mongolia | 6 |
| Anhwei | 16 |
| Hunan | 7 |
| Szechwan | 1 |
| Fukien | 5 |

Besides these four specimens from Nodda, Hainan, which have been noticed in a previous paper in this series of reports, have been at hand.

The primary division in this entire series seems to be plainly between the Hainan specimens and those of the Chinese mainland from Fukien

north. The Hainan specimens are broader when adult (over 200 mm. in length of carapace); their greatest breadth is anterior to the middle of the carapace; and the ventral pattern is more vivid, apparently more constant, and more persistent with increasing age, than is the case in the northern specimens. As the type locality of *A. sinensis* is Macao, there can be little doubt of the correctness of referring these Hainan specimens to *sinensis* s.s. A much larger series of this form is required to establish the limits of variation of this form, and its range to the north is quite unknown.

Reserving provisionally the name *japonica* for the Japanese turtles, the next available name for the turtles of northern China is *Amyda tuberculata* (Cantor). The type locality of this species is Chusan, which seems geographically satisfactory for the Yangtze Valley form; and for the present material it seems best to employ no other name.

The series from Fukien consists of two juvenile specimens, a medium-sized one, and two of 166 and 174 mm. respectively. There is no ventral pattern in these specimens.

The Szechwan specimen is a monstrosity of the type figured by Mell and named "*cyphus*" by Vogt. There are no ventral markings. Its depth of shell is 0.37 of the length of the plastron.

The Hunan specimens are small, the largest measuring only 108 mm., and therefore are unsatisfactory for the comparison of measurements with adults which, as far as I am able to determine, are less variable than the juvenile specimens. There is no plastral pattern except the markings on the soft parts. The specimen from Changsha, 108 mm. in length of plastron, is relatively broad and its breadth is anterior. In this respect it is decidedly the closest approach to the Hainan specimens in the whole northern series.

The Anhwei series consists of two adult males of 182 and 193 mm., three medium-sized, and eleven juvenile specimens. In the latter the plastral pattern is well-marked in two specimens, four specimens have a reduced pattern of from one to four spots, and five have no pattern except for the lateral spots. In the three larger specimens the breadth of carapace varies from 0.75 to 0.79 of its length.

The six specimens from Chihli should be referable to *A. schlegelii* but I have not been able to find characters to separate them from the Anhwei or from Fukien specimens of similar size. Their depth of shell ranges only from 0.23 to 0.26 of the length of the carapace.

The Shansi series ranges in size from 62 mm. to 140 mm., and is thus without either juvenile or fully adult specimens. Only one specimen has a plastral pattern.

The six male specimens from the Hwang Ho near Paotowchen, Mongolia, north of Ordos, range in size from 217 to 275 mm. This series is the most distinct of those examined, with a narrow carapace, a short plastron, and the least depth of shell. Neither these nor the Hsing Lung Shan specimens correspond with Stejneger's deep-bodied *schlegelii*, and I suspect that, even if *schlegelii* should prove recognizable, other characters will have to be chosen to distinguish it.

On account of the very important variation in proportions with age, it is essential to compare specimens of approximately equal size. The present series is accordingly wholly inadequate for the solution of what may be called the "*sinensis*" problem, and the present remarks are preliminary to a more extended study when additional specimens become available.

LORICATA

Crocodylidae

Alligator sinensis Fauvel

Alligator sinensis FAUVEL, 1879, Journ. N. China Branch Roy. Asiatic Soc., XIII, p. 1, figs. VAILLANT, 1880, Ann. Sci. Nat., (6) IX, Art. 8. BÆTTGER, 1885, Ber. Offenbacher Ver. Naturk., XXIV-XXV, p. 25 (of reprint); 1888, idem, XXVI-XXVIII, p. 111. GÜNTHER, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 219. BOULENGER, 1889, 'Cat. Chelon. Brit. Mus.,' p. 291; 1890, Proc. Zoöl. Soc. London, p. 619, Pl. LI-LII. BÆTTGER, 1893, 'Kat. Rept. Mus. Senck.,' I, p. 19; 1894, Ber. Senck., Ges. p. 142. GADOW, 1901, 'Amphibia and Reptiles,' p. 471. WERNER, 1903, Abh. Bayer. Akad. Wiss., 2 Kl., XXII, p. 360. COAN, 1908, Jahrb. Samml. Bremen, I, part 2, p. 1, Pl. 1. BARBOUR, 1910, Proc. Acad. Nat. Sci. Phila., 1910, p. 464. WERNER 1912, 'Die Lurche und Kriechtiere,' I, p. 548, Pl. BOULENGER, 1914, 'Reptilia and Batrachia,' p. 45, Pl. STANLEY, 1914, Journ. N. China Branch Roy. Asiatic Soc., XLV, p. 22. BARBOUR, 1922, Proc. New England Zoöl. Club, VIII, p. 31. MOOK, 1923, Bull. Amer. Mus. Nat. Hist., XLVIII, p. 553, figs. 1-2. STEJNEGER, 1925, Proc. U. S. Nation. Mus., LXVI, p. 34, Art. 25.

Twenty specimens of this species were secured by Mr. Pope. Of these, A. M. N. H. Nos. 23899-23901 are prepared as skulls, 28690-28692 are alcoholic specimens, and 28681-28689, 28693-28696 are dry skins with complete skeletons.

The Chinese alligators collected by Mr. Pope have been noticed in a paper on the skull of this form by Dr. C. C. Mook (1923). The species is included here to complete the series of reports on the reptiles and to record Mr. Pope's interesting field notes, which, it is hoped, he may amplify on a future occasion.

"I bought nineteen alligators in all for \$19.60. There are apparently no very small ones now, or else the small ones are more difficult to obtain. My smallest specimens are about two feet long.

"These alligators were dug out of holes in a grassy plain by the side of the Ching Ssui Ho, the river that flows from the south through Wuhu and into the Yangtze. This plain is about seven miles up-stream from Wuhu, and is well known to the Chinese as the home of a numerous colony of alligators. The plain is treeless, and even the grass is sparse. At this time of year the river flows between steep banks, perhaps twenty-five feet high. In the fall, at flood time, the Yangtze backs up until the plain above these banks is flooded. This is perhaps the reason why the plain where the alligators are found is not cultivated.

"The Chinese say that there are two other colonies within a few miles, and these three are apparently the only ones in this region.

"The alligators are very numerous at this locality. The entire lot was dug up in less than a week, and the supply appeared to be unlimited. The holes in which they are found are about a foot in diameter at the mouth, and seem to run in at an angle to a depth of about five feet.

"At this time the alligators are still hibernating and are quite inert when dug out, so that they may be handled quite freely. They will not use their tails in defense, though some of them will 'roar' and bite a little. If put on the ground, they will not attempt to run and have to be teased to become at all aroused. It was interesting to find a wild cat in the same mound, probably in the same hole, with a large alligator." (C. H. P.)

SAURIA

Gekkonidæ

Gekko japonicus (Duméril and Bibron)

Thirty-four specimens, from three localities, are referable to this species: A. M. N. H. No. 23585, Yenping, Fukien, 1921, H. R. Caldwell; and 31121, Kolan, Shansi, summer, 1922, and 31122-31135, 31137-31153, 31202, Ningkwo, Anhwei, September-October, 1921, Clifford H. Pope. Five specimens, collected by J. W. Williams at Changsha, Hunan, July, 1920, and presented to the American Museum, have also been examined.

These specimens agree in the presence of distinct dorsal tubercles, which amply distinguish the species. It is surprising to find an unquestionable specimen of this species from Shansi, from which province Mr. Pope secured large numbers of *G. swinhonis*; and the single specimen from Yenping, Fukien, was associated with *G. subpalmatus*. The preanal pores of the males of this series range from five to eight, eight occurring once, seven four times, six seven times, and five once.

The variation in the arrangement of the postmentals is of interest in comparison with that of *swinhonis*. The median pair of postmentals extends normally as far as or farther than the lateral pair. One or both of the first pair may be transversely divided, and No. 31121 has a median postmental. The enlarged scales which border the median pair vary in number from two to six, distributed as follows:

| SCALES BORDERING POSTMENTALS | NUMBER OF SPECIMENS |
|------------------------------|---------------------|
| 2 | 2 |
| 3 | 9 |
| 4 | 12 |
| 5 | 9 |
| 6 | 5 |

***Gekko swinhonis* Günther**

Eighty-three specimens represent this species: A. M. N. H. Nos. 21340-21342, 21344-21373, Hsing Lung Shan, Chihli, August, 1921; 31136 and 31434, So Huang, Ping Ting, Shansi, September, 1922; and 31154-31201, Chen Tzu, Taiyuan, Shansi, July-August, 1922, all collected by Clifford H. Pope.

The two specimens from So Huang, Ping Ting differ from the others in lacking entirely the slightly enlarged scales which are scattered among the otherwise uniform dorsal granular scales of the Chen Tzu and Chihli series. A series of specimens from So Huang is a desideratum.

The number of preanal pores and the arrangement of the second row of postmentals contrasts with these characters in *G. japonicus*. They vary as follows:

| NUMBER OF PREANAL PORES | NUMBER OF SPECIMENS |
|------------------------------|---------------------|
| 6 | 5 |
| 7 | 6 |
| 8 | 7 |
| 9 | 3 |
| SCALES BORDERING POSTMENTALS | NUMBER OF SPECIMENS |
| 2 | 39 |
| 3 | 28 |
| 4 | 15 |
| 5 | 0 |
| 6 | 1 |

***Gekko subpalmatus* Günther**

Four specimens are referable to this species: A. M. N. H. Nos. 18611, 20990, Yenping, Fukien, August, 1916, R. C. Andrews and Edmund Heller; 23586; Fukien Province (doubtless near Yenping), 1921, H. R. Caldwell; and 23608, Wanhsien, Szechwan, December, 1921, Walter Granger.

The palmation of the digits is rather variable, and reaches a maximum in No. 23608, which may be said to have the toes nearly half webbed. The scales bordering the postmentals posteriorly are two or three in number. The single male specimen has ten preanal pores.

Gekko gekko (Linnæus)

Four specimens of this species in the American Museum collections were sent by Mr. John Graham from Yunnanfu, but it is possible that they actually come from Tonkin. A specimen of *Hemidactylus frenatus*, also from Mr. Graham, was labeled Hanoi, Tonkin.

Hemidactylus bowringii (Gray)

A single specimen, collected by Mr. Graham at Yunnanfu, October 20, 1920, represents this species. It agrees closely with a Field Museum specimen from Lilong, Canton, Kwangtung, received from the Basel Museum.

Cainodactylus yunnanensis (Boulenger)

Thirteen specimens of this species in the American Museum's collections have been examined. All come from Yunnanfu, Yunnan, the type locality. They are in excellent agreement with Barbour's recent redescription (1924, p. 134). The femoral pores in five male specimens vary from 15 to 23.

Agamidæ

Acanthosaura dymondi Boulenger

A single topotypic specimen, A. M. N. H. No. 12802, collected in the Wutingchow district, Yunnan, May 3, 1919, by John Graham, is in the collection. It has 7-8 upper labials; lower labials 8-8; total length 172 mm.; tail 113 mm.; arm 26 mm., and leg 38 mm.

Acanthosaura kakhienensis (Anderson)

Seventeen specimens, A. M. N. H. Nos. 19881-19887 and 20970-20979, were collected at Tengyueh, Yunnan, May, 1917, by R. C. Andrews and Edmund Heller.

This form is well characterized by its distinct vertical patches of enlarged lateral scales. It is excellently figured by Boulenger (1887a, Pl. VI, fig. 2) as *Calotes fœæ*.

Summary of Scale Characters and Measurements

| | SEX | NUMBER OF SPECIMENS | EXTREMES | AVERAGE |
|----------------------|-------|------------------------|-------------|---------|
| Upper Labials | ♂ + ♀ | 17 | 6- 8 | 6.5 |
| Lower Labials | ♂ + ♀ | 17 | 6- 8 | 7.0 |
| Total Length | ♂ + ♀ | 15 | 193-258 mm. | 234 mm. |
| Length of Body | ♂ + ♀ | 17 | 73- 97 | 87 |
| Hind Leg/Body Length | ♂ + ♀ | 17 | .51-.63 | .58 |
| Tail/Total Length | ♂ + ♀ | 15 | .60-.64 | .62 |

***Acanthosaura lamnidentata* Boulenger**

Seven specimens, A. M. N. H. Nos. 19867-19869, 18609, and 23605-23607, collected by H. R. Caldwell, 1917-1921, near Yenping, Fukien.

The upper labials in this series range from 10 to 13. The tail length varies from 0.59 to 0.64 of the total.

***Acanthosaura varcoæ* Boulenger**

A single specimen, A. M. N. H. No. 18880, ♀, collected at Snow Mountain Village, 9000 feet altitude, Likiang, Yunnan, November, 1916, by R. C. Andrews and Edmund Heller. Five topotypes, in the American Museum collection, have been available for comparison.

The nearest relative of this form appears to be *Acanthosaura tricarinata*, from which it is well distinguished by the presence of two distinct rows of keeled scales on each side of the dorsal crest. In the Likiang specimen the upper labials are 7-8; the lower labials 6-8. The total length is 175 mm.; tail 108 mm.; body 67 mm.; arm 31 mm.; and leg 42 mm.

This specimen was associated with *Japalura flaviceps*, from which it is almost indistinguishable in habitus. Werner's record of *dymondi* from Likiang (1924, p. 40), may possibly belong with this form.

***Japalura flaviceps* Barbour and Dunn**

The two specimens in the collection, A. M. N. H. Nos. 19878, Likiang, Yunnan, and 19879, Snow Mountain Village, Likiang, Yunnan, collected by R. C. Andrews and Edmund Heller, November, 1916, are paratypes of this form (Barbour and Dunn, 1919, p. 16).

Measurements and labials of these two specimens are as follows:

| | | |
|-------------------|---------|---------|
| A. M. N. H. No. | 19878 | 19879 |
| Sex | ♀ | ♂ |
| Upper Labials | 8-9 | 7-7 |
| Lower Labials | 9-10 | 9-9 |
| Total Length | 148 mm. | 116 mm. |
| Length of Body | 60 | 48 |
| Length of Arm | 26 | 22 |
| Length of Leg | 42 | 30 |
| Tail/Total Length | .59 | .59 |

Werner, 1924, p. 41, refers a specimen of a *Japalura* from Likiang, Yunnan, to *yunnanensis*, with a remark on the difficulty of distinguishing *flaviceps* and *splendida*. This difficulty must be due to the lack of genuine *yunnanensis* in his material, for I find them entirely distinct. In *flaviceps* there is a strong suggestion of a pair of dorsolateral rows of keeled scales, much like those of *Acanthosaura varcoæ*; the lateral scales are small, nearly uniform, with a few rather isolated enlarged scales. All of the upper head scales are keeled, while in *yunnanensis* they are rugose or many-keeled. The latter has much larger laterals, with more numerous enlarged scales, which tend to form transverse rows, suggesting *A. kakhienensis*. It seems possible that *Japalura* is a "polyphyletic genus" whose different sections are derived from different sections of *Acanthosaura*. There is apparently a correlation of concealed tympanum with occurrence at high altitudes, which presents a problem meriting extended study and observation. *Japalura splendida* is so distinct in habitus, head form, and coloration from the above species, that it requires no comparison with them.

***Japalura splendida* Barbour and Dunn**

Plate XXIX, Figure 2

Eighteen specimens, A. M. N. H. Nos. 23543-23549, 23551-23553, 23558-23565, from Yenchingkau, 1500 feet altitude, Wanhsien, Szechwan, November, 1921, collected by Walter Granger.

This very strikingly colored form is apparently abundant in central Szechwan. The variation in number of labials is as follows:

| NUMBER OF LABIALS | UPPER LABIALS No. COUNTS | LOWER LABIALS No. COUNTS |
|-------------------|-----------------------------|-----------------------------|
| 7 | 5 | 0 |
| 8 | 26 | 25 |
| 9 | 5 | 8 |
| 10 | 0 | 3 |

The range of measurements is as follows:

| | SEX | NO. OF SPECIMENS | EXTREMES |
|--------------------------|-----|---------------------|-------------|
| Length of Body | ♂ | 15 | 50- 89 mm. |
| Length Leg Body/Length | ♂ | 15 | .80-.92 |
| Total Length | ♂ | 15 | 163-256 mm. |
| Length Tail/Total Length | ♂ | 15 | .65-.71 |

The color-pattern of a juvenile female (57 mm. body length) closely approaches that of *Japalura flaviceps*. In a larger female (77 mm. body) the pattern of transverse dark dorsal markings is included between broad light dorsolateral bands. In the smallest male specimen (50 mm. body) the more "contrasty" male pattern is already well developed.

Japalura yunnanensis Anderson

Seven specimens from Yunnan, A. M. N. H. Nos. 19871-19874, 19876-19877 Tengyueh, May, 1917, and 19875, Homushu Pass, April 2, 1917, collected by R. C. Andrews and Edmund Heller.

This series has been mentioned by Barbour and Dunn (1919). The Tengyueh specimens are topotypes.

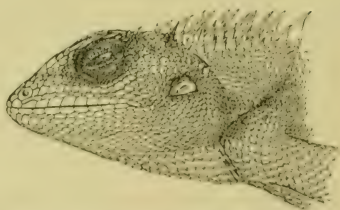


Fig. 3. *Calotes alticristatus*, new species.
Head of type from the side, natural size.

Calotes alticristatus, new species

Figure 3

TYPE.—A. M. N. H. No. 17395; ♀; Yunnanfu, Yunnan; 1919; John Graham.

DIAGNOSIS.—Closely allied to *Calotes emma*, from which it is distinguished by the following characters: (1) a greater number of scales around the body; (2) smaller postcanthal and nuchal spines; (3) a much longer nuchal crest; (4) larger tympanum; (5) no dorsolateral light line.

DESCRIPTION OF TYPE.—Body stout, slightly compressed, head large, limbs and tail long.

Upper head scales imbricate, keeled, sixteen between the supraciliary borders above the eyes; supraoculars slightly enlarged; ten scales on the canthal and supraciliary border; a small spine just behind this series; two groups of spines on each side between the tympanum and the nuchal crest, the longest about half the diameter of the tympanum; upper labials 9-11, lower labials 9-9 dorsal scales keeled, slightly larger than the ventrals, 65 around the body; keels directed upward and backward on the upper half of the body; a strong oblique fold on each side in front of the shoulder covering an area of granular scales; ventrals strongly keeled, largest on the longitudinal gular fold; nuchal crest of eighteen flattened spines, gradually merging into the low dorsal crest, the longest spines 7 mm.

General color olive-green, with about seven transverse dark dorsal bands reaching halfway down the sides; fold on side of neck black; eye with radiating black lines, one extending to the tympanum.

Measurements as follows:

| | |
|--|---------|
| Total Length | 407 mm. |
| Body | 113 |
| Tail | 294 |
| Arm | 56 |
| Leg | 85 |
| Snout to Posterior Border of Tympanum | 30 |
| Horizontal Diameter of Tympanum | 5 |

I was at first inclined to identify the above specimen as *Calotes yunnanensis* Annandale, whose type locality is Tengyueh. It seems to be distinguished from *yunnanensis* by the greater number of scales around the body, and probably by a difference in the fold in front of the shoulder. It may be remarked that there are remarkably few species whose range includes both Tengyueh and Yunnanfu.

***Phrynocephalus frontalis* Strauch**

A. M. N. H. Nos. 23944-23954, 23956-23991, 23993-23999, 24001-24042, 28350 and 31235, collected at Mai Tai Chao (43 miles E. of Paotowchen), Shansi, May, 1922, by Clifford H. Pope.

The *Phrynocephalus* of northern Shansi are readily distinguished from our Mongolian specimens by the small size of their supraocular scales, which number from 25 to 35, average 29.5, across the top of the head, in twenty specimens.

The final identification of species in this genus will require a large amount of material from typical localities, as well as an exhaustive study of Bedriaga's revision (cf. Stejneger, 1925a, p. 41).

"While crossing the sandy plain east of Sa Hsien (April 26) we found many of the little sand-lizards, which were abundant in the more sandy spots. They scooted in every direction from beneath our feet. Many dodged into holes, but we chased others until we caught them; they attempted to escape by short dashes, and after a minute or two of persistent pursuit were tired out so that they could be picked up. The large ones were hard to catch.

"When chased in loose sand, one of these lizards would frequently stop and by rapid wriggling of the body cause himself to sink into the sand until almost out of sight. In this position his coloration was a perfect match for the sand. I did not see one go completely beneath the surface.

"A more puzzling habit was frequently observed. While being pursued the lizard would come to a full stop, erect his tail to the perpendicular, and then roll it up and down over his back two or three times. After another short dash, this performance would be repeated.

"Even when rocks were numerous and readily available as hiding places, this species rarely made use of them. Many individuals, stationed in front of their burrows, would dive into them at the first sight of danger. Others would refuse to be chased into their holes, but made repeated short dashes away from the pursuer, making circuits so as to return to their original positions beside their burrows.

"The openings of the burrows were somewhat crescentic, about five times as wide as high. The eight burrows examined ranged from four to eight inches in vertical depth, with a horizontal length of from eight to twelve inches." (C. H. P.)

***Phrynocephalus cf. versicolor* Strauch**

A. M. N. H. Nos. 31239-31254, collected between Pang Kiang and Iren Dabasu, summer, 1922, by R. C. Andrews.

A. M. N. H. Nos. 31236-31238, 260 miles S.E. of Sairusu on the Katgan Trail, and 31255-31294, Tsagan Nor, Gobi Desert, collected in the summer of 1922 by R. C. Andrews.

The Pangkiang and Tsagan Nor series offer slight differences, but in the present status of the genus it does not seem profitable to emphasize them. These differences, as well as the contrast between the Mongolian and Shansi specimens, appear in the attached tabular summary of characters.

Tabulation of Characters of *Phrynocephalus frontalis* and *P. versicolor*

| | Sex | Upper Labials | | | Rows of Scales Between Eye and Labials | | | Scales in a Row Across Top of Head | | | Total Length mm. | | | Length Leg/Body | | | Tail/Total Length | | |
|----------------------------------|-----|---------------|----------|------|--|----------|------|------------------------------------|----------|------|------------------|----------|------|-----------------|----------|------|-------------------|----------|------|
| | | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean |
| <i>Phrynocephalus frontalis</i> | ♂ | 10 | 12-18 | 15.0 | 10 | 3-5 | 3.8 | 10 | 25-36 | 29.5 | 10 | 102-123 | 111 | 10 | 71-83 | 79 | 10 | 52-57 | 55 |
| (Northern Shansi) | ♀ | 10 | | | 10 | | | 10 | | | 10 | 97-118 | 109 | 10 | 71-82 | 74 | 10 | 52-55 | 54 |
| <i>Phrynocephalus versicolor</i> | ♂ | 11 | 12-16 | 13.4 | 11 | 3-4 | 3.7 | 11 | 18-24 | 21 | 10 | 107-119 | 113 | 11 | 74-83 | 75 | 10 | 54-58 | 56 |
| Pangkiang, Mongolia | ♀ | 5 | | | 5 | | | 5 | | | 5 | 105-110 | 107 | 5 | 67-78 | 72 | 5 | 50-54 | 52 |
| Tsagan Nor, Mongolia | ♂ | 10 | 13-17 | 14.8 | 10 | 3-5 | 4.2 | 10 | 18-23 | 21 | 9 | 106-124 | 114 | 10 | 76-86 | 81 | 9 | 55-58 | 56 |
| | ♀ | 10 | | | 10 | | | 10 | | | 10 | 104-116 | 109 | 10 | 67-80 | 74 | 10 | 52-56 | 54 |

Anguidæ***Ophisaurus harti* Boulenger**

The single specimen, A. M. N. H. No. 20981, comes from Shaowu, Fukien, collected by H. R. Caldwell, 1916.

This specimen agrees exactly with Boulenger's description and figure (1899, p. 160 Pl. xvi) except in having 114 transverse rows of dorsal scales. It is not at all like his specimens in coloration. The general dorsal color is pale brown, the ventral color pale yellowish gray; scattered small dark spots are present on the head and chin, less marked on the back, and more pronounced on the tail; a dorsolateral brown line on the posterior third of the body, extending to the tip of the tail.

***Ophisaurus gracilis* (Gray)**

Three specimens from Yunnanfu, A. M. N. H. Nos. 20980, 22700, 22701, collected by the Rev. Graham, have three scales in a line between the prefrontal and the rostral, and are thus referable to *O. gracilis* rather than to *O. harti*.

Lacertidæ***Takydromus amurensis* Peters**

A. M. N. H. No. 8910, Mukden, Manchuria, collected by M. Nishimura, August, 1913, represents this species. It has five pairs of chin shields and three femoral pores on each side.

***Takydromus wolteri* Fischer**

Ninety-seven specimens of this form are in the collection, from the following localities: A. M. N. H. No. 23625, Fukien Province, H. R. Caldwell; 23624, 23626-23634, Wanh sien, Szechwan, 1921, Walter Granger; and 31307-31312, 31314-31316, 31318-31319, 31321-31361, 31363-31378, 31380-31388, 31390-31393, 31395, 31397-31400 from Ning-kwo; September-October, 1921; C. H. Pope.

In the sixty Ningkwo specimens examined, the dorsal rows of enlarged scales number 7 in four specimens, 8 in fifty-three, and 9 in three. The ventrals are uniformly in 8 rows, with two to four rows of enlarged, keeled laterals adjacent to them on each side. The chin-shields are 5-5 in two, 4-5 in two, otherwise 4-4. Femoral pores invariably 1-1.

In 86 specimens, 69 have two prefrontals; 3 have a small median scale between the prefrontals, not entirely separating them, and 14 have a median prefrontal, i.e., a row of three prefrontals

No important variation is to be found in the ten Szechwan specimens. A specimen from Mukden (A. M. N. H. No. 8911, collected and presented by M. Nishimura) falls within the variation limits of the Ningkwo series. The single specimen from Fukien has 25-27 lamellæ beneath the fourth toe, but otherwise agrees with the remaining series. It should perhaps be compared with the Formosan species.

The largest male specimen measures 190 mm.; tail 143 mm.; the largest female 193 mm.; tail 142 mm.

Summary of Scale Characters and Measurements (Ningkwo series):

| | SEX | NUMBER OF SPECIMENS | EXTREMES | AVERAGE |
|------------------------|-----|------------------------|----------|---------|
| Ventrals in a | ♂ | 27 | 27-31 | 29 |
| Longitudinal Row | ♀ | 33 | 28-32 | 30 |
| Gulars from | ♂ | 27 | 22-23 | 26 |
| Collar to Chin-shields | ♀ | 33 | 23-31 | 27 |
| Lamellæ beneath | ♂ | 27 | 21-24 | 22 |
| the 4th Toe | ♀ | 33 | 20-26 | 23 |
| Length of Leg/ | ♂ | 27 | .44-.50 | .47 |
| Length of Body | ♀ | 33 | .40-.50 | .45 |
| Tail-Length/ | ♂ | 20 | .70-.75 | .72 |
| Total Length | ♀ | 18 | .70-.74 | .72 |

Takydromus septentrionalis Günther

Thirty specimens, A. M. N. H. Nos. 23554, 23556, 23589, 23599-23600, Yenchingkau, October, 1921, and 23601-23604, Wanhsien, Szechwan, December, 1921, Walter Granger; 23568, Yochow, Hunan, 1922, Clifford H. Pope; and 31295-31306, 31313, 31317, 31320, 31362, 31379, 31389, 31394, 31396, Ningkwo, Anhwei, September, October, 1921, Clifford H. Pope.

The Szechwan and Anhwei series of this species are in close agreement, and they fall within the limits of the British Museum series reported upon by Boulenger (1921, p. 137).

Takydromus sexlineatus meridionalis (Günther)

Thirteen specimens of this species, A. M. N. H. Nos. 18616, 23613-23623, and 23584, were collected in Fukien Province by H. R. Caldwell.

In this series the chin shields are invariably three pairs, the femoral pores uniformly one on each side. The dorsals are in six rows in one specimen. In other characters the series falls within the limits of the large Hainan series which has been reported upon elsewhere.

Takydromus intermedius Stejneger

A. M. N. H. Nos. 22697-22698, collected at Yunnanfu, Yunnan, by John Graham, agree closely with the diagnosis of this form, described from Mt. Omei, Szechwan.

All have seven series of enlarged dorsals and six series of ventrals; 23-26 ventrals from anal plate to collar; 25-27 lamellæ beneath the fourth toe; all have four pairs of chin-shields and two femoral pores on each side. No. 22698 measures 171 mm.; tail 129 mm

Eremias przewalskii Strauch

Plate XXIX, Figure 1

Ten specimens from Mongolia, collected by R. C. Andrews, summer of 1922. A. M. N. H. Nos. 31503-31504 come from 260 miles S.E. of Sairusu, on the Sairusu-Kalgan trail; 31505-31506 from Pangkiang to Iren Dabasu; and 31507-31512 from Tsagan Nor, Gobi Desert.

The number of ventrals in a transverse row ranges from 16 to 18; the number of gulars from collar to chin-shields from 27 to 34; the number of femoral pores from 10 to 15. The labials anterior to the subocular are 5 in four counts, 6 in twelve, and 7 in four. The subocular reaches the labial border on both sides in one specimen. Variation in other characters is shown in the comparative table.

The extreme development of the vermiculate dorsal pattern is seen in the largest male specimens. Juvenile and female specimen show a tendency toward a pattern of longitudinal lines.

Eremias argus Peters

Plate XXX, Figure 1

Seventy-five specimens, A. M. N. H. Nos. 21374-21427 and 21429-21449, collected at Hsing Lung Shan, Eastern Tombs, Chihli, August, 1921, by Clifford H. Pope.

This series is without doubt representative of typical *argus*. Boulenger's description of the coloration of this form (1921, p. 338) includes both the typical ocellated pattern and the lineate and cross-barred pattern which is the usual coloration of the western species here described as *Eremias barbouri*, but he states that the ocellate pattern is more frequent. Boulenger's description of the juvenile pattern does not agree with the present series, thirty-five of which are juvenile specimens and have a pattern of distinct, black ringed, white spots, with longitudinal lines only on the temples. In the forty adult specimens, transverse black bars connect the spots in thirteen, and the spots are well isolated in twenty-seven.

The ventrals in a transverse row are 12 in one specimen, 13 in eight, 14 in thirty, and 15 in one. The labials anterior to the subocular are 4 in ten counts, 5 in a hundred and twenty-one, and 6 in nineteen. In the whole series, the suboculars reach the labial border on only one specimen, and on one side in another, with no correlation with other *brenchleyi* characters.

The number of gulars bordering the last pair of chin-shields in contact varies from two to nine, averaging 5.0. The number of gulars in line between the collar and chin-shields in forty specimens ranges from nineteen to twenty-five, averaging twenty-one. Variation in number of femoral pores is independent of sex (see below, under *E. barbouri*). Variation in measurements and in dorsal and ventral scale counts is shown in the comparative table (see below).

Three specimens from Manchuria, presented to the American Museum by Mr. M. Nishimura, agree closely with the Chihli series.

***Eremias barbouri*,¹ new species**

Plate XXX, Figure 2; Figure 4

TYPE.—A. M. N. H. No. 24045; ♂; Mai Tai Chao, (40 miles east of Paotow-chen) Shansi; May, 1922; Clifford H. Pope.

DIAGNOSIS.—Directly allied to *Eremias argus*, from which it may be distinguished by its larger dorsal scales and a color pattern of light longitudinal lines combined with transverse black bars.

DESCRIPTION OF TYPE.—Habitus unspecialized, head broad and deep, blunt in profile.

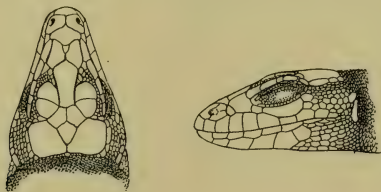


Fig. 4. *Eremias barbouri*, new species.
Dorsal and lateral views of head of type, $\times 2$.

Rostral pentagonal, in contact with the first labials and supranasals; supranasals much larger than the subnasal and postnasal together, broadly in contact behind the rostral, a single frontonasal, partly divided, much broader than long, in contact with the supranasals, the prefrontals, and narrowly with both loreals; a pair of prefrontals

¹Named for Dr. Thomas Barbour, of the Museum of Comparative Zoölogy, Cambridge, Massachusetts.

in contact, longer than broad, with a small median anterior scute between them, each broadly in contact with the second loreal and the frontal, not in contact with the first supraciliary; frontal as long as its distance from the rostral, in contact posteriorly with the first supraocular, and very narrowly, on one side, with the second; two large supraoculars, followed by a very small one; four supraciliaries on each side, separated from the prefrontal and frontal by granules, which are reduced to a single series between the supraciliaries and the supraoculars; frontoparietals smaller than the posterior supraoculars, larger than the interparietal, much shorter than the parietals, in contact with the second large supraocular; parietals broadly in contact behind the interparietal; a series of four scales along the side of each parietal; two loreals, the anterior narrow, vertical; five labials on each side anterior to the subocular, which is cut off from the labial border by a sixth labial; chin-shields 4-5, the first one on one side being transversely divided.

Back covered with small uniform granular scales, forty-eight across mid-body; fifteen ventrals in the longest transverse row; thirty-two transverse rows of ventrals; eleven enlarged scales in the collar; eighteen gulars from collar to chin shields; five gulars border the last pair of chin-shields in contact; a transverse row of small scales on the neck indicates a slight gular fold; femoral pores 11-12; lamellæ beneath the fourth toe twenty-two.

Color olive-gray above, with a pair of interrupted dorsolateral lines from the corners of the parietals to the base of the tail, on which they extend for a short distance; a double row of dorsal white spots between the dorsolateral lines, continuing as a single row on the base of the tail; a broad light lateral line, composed of united spots, and bordered with a few round black spots below; a series of black transverse bars above and below the dorsolateral lines, corresponding to the original spots, and extending to the dorsal and lateral lines; a few median dorsal black spots; venter uniform yellowish white; fore limbs with a few, hind limbs with numerous black spots.

Total length 123 mm., tail 68 mm., body 55 mm., leg 27 mm., leg/body, .49.

NOTES ON PARATYPES.—One hundred and seventy-one paratypes, all collected by Clifford H. Pope from localities in Shansi, have been examined in some detail. Of these Nos. 28348-28349, 31435, 24043-24044, and 24046-24141 are from Mai Tai Chao, May, 1922; 31411, 31418, 31425 and 31431 from So Huang Ping Ting, September, 1922; 31436-31442 from Ma Ying Hai, Ningwu July-August, 1922; and 31443-31495 and 31497-31502 from Chen Tzu. Taiyuanfu, July-August, 1922.

This large series shows a high degree of variability. A number of characters are compared with both *brenchleyi* and *argus* under the discussion of *brenchleyi* (see below). The variation in dorsals, ventrals, and measurements is shown in the comparative table for the genus.

In the four specimens from So Huang, Ping Ting, which were associated with *brenchleyi*, the dorsals across the body range from 46 to 59, and one specimen has the color pattern typical of *argus*. These specimens are thus possibly intergrades between *argus* and *barbouri*, while less close to *brenchleyi* than the series of *barbouri* from other localities.

In the seven specimens from Ningwu, which agree excellently with *barbouri* in scale characters, the pattern is ocellate, and apparently like

that of *argus*. The dorsal ocellæ of *argus*, however, differ from the Ningwu series, and from *barbouri* in general, by being more widely spaced. In the Chen Tzu series the dorsal scales are somewhat smaller than in the topotypes.

The subocular reaches the labial border in four specimens, (very narrowly in two), and on one side in two more of the Mai Tai Chao series. Four specimens from Chen Tzu have the same character, but all of these agree in other respects with *barbouri* and not with *brenchleyi*. This character, which is normal in *brenchleyi*, may appear as an abnormality in both *argus* and *barbouri* without making the specimen in any sense an intergrade with *brenchleyi*; its occurrence in a high percentage of specimens from a given locality might be taken as evidence of intergradation. Specimens of *brenchleyi* in which the subocular is cut off from the lip may be expected; but the So Huang, Ping Ting specimens referred to *barbouri* can not be so regarded on account of their color and scale characters.

Juvenile specimens from Chen Tzu all have an interrupted dorso-lateral and lateroventral white line; the lateroventral line forks in front of the shoulder and passes under and over the ear; the dorsolateral line is continuous anteriorly, and begins at the corner of the parietal; two series of dorsal white spots form straight lines, their black borders mostly connected with that of the dorsolateral line; the dorsolateral line continues on the base of the tail, (*argus* has spots on the base of the tail); the entire space between the two lateral lines is frequently dark, and the black on the back may be so increased as to leave only a distinct gray mid-dorsal band between the dorsal lines.

In twenty adults from Chen Tzu, all but one have the dorsolateral spots strongly elongated to form a well-defined dorsolateral line; this is quite continuous in No. 31491; dorsal white spots are never absent; transverse black bars on the back connect the spots, and are well marked in all except 31498, which has isolated ocellæ, only a few of which are connected by black markings.

Adult Mai Tai Chao specimens agree in coloration with the type. In forty juvenile specimens an ocellate pattern occurs in three, and these prove readily distinguishable from juvenile *argus* on direct comparison, as they have a larger number of spots and a much better defined lateroventral line.

"At Mai Tai Chao the Chinese call this lizard 'Rock Lion.' It is well named, as it was found only where rocks were plentiful, and it invariably sought shelter under or among them when alarmed. Its dashes

for safety are much swifter and longer than those of the Sand Lizard (*Phrynocephalus*). Its attempts to hide under bushes only if no rocks are available.

"In the course of a two-hour walk through the dry, bushy, elevated area to the southeast of Chen Tzu, I saw fourteen 'Rock Lizards.' Instead of making for the stones and boulders, which were numerous at various places on the plain, these specimens nearly always made for a bush, hiding beneath it, or dodging around it. Only when hard pressed would they resort to holes beneath rocks." (C. H. P.)

***Eremias brenchleyi* Günther**

Plate XXX, Figure 3

Thirty specimens are referred to *Eremias brenchleyi*; A. M. N. H. Nos. 31401-31410, 31412-31417, 31419-31424, 31426-31430, 31432-31433 from So Huang, Ping Ting, Shansi, September, 1922, and 31496, Chen Tzu, Taiyuan Fu, Shansi, July-August, 1922, collected by Clifford H. Pope.

It is gratifying to find a series of specimens representing this form, whose status was somewhat uncertain, even in Boulenger's latest revision (1921, p. 339). Unfortunately, even the present collection does not give the key to its distribution. The confusion of *brenchleyi* with typical *argus* has been largely due to the failure to distinguish between eastern *argus* and the Shansi form which I have described above as *E. barbouri*. It is highly probable that all three of these forms are connected by intergrades, as they are in fact connected by overlapping extremes in all of the characters which distinguish them. I have retained them as distinct forms, rather than as subspecies, only on account of my inability to explain their geographic relations. The range of *argus* is Korea, Chihli, and Shantung; type locality, Chefoo. That of *barbouri* is Shansi and probably southern Mongolia; type locality, Mai Tai Chao, northern Shansi. And *brenchleyi*, whose type locality is "Land of Grass," Mongolia, appears in the present collection from eastern Shansi, thus inserted between the ranges of *barbouri* and *argus*. It seems likely that when the necessary field observations are made, habitat or altitude preference may afford a simple explanation of geographic ranges which at present appear complicated.

In the present series, which are at once placed with *brenchleyi* on account of the descent of the subocular to the labial border, the low number of dorsal scales across the back, the tendency to uniform dorsal coloration, and the more pointed head are in further agreement with the

descriptions of Günther and Boulenger. The average values of other characters differ from both *barbouri* and *argus*. Thus, the femoral pores of the three forms vary as follows:

| NUMBER OF FEMORAL PORES ON ONE SIDE | NUMBER OF SPECIMENS | | |
|--|---------------------|-----------------|-------------------|
| | <i>argus</i> | <i>barbouri</i> | <i>brenchleyi</i> |
| 7 | 1 | 3 | .. |
| 8 | 7 | 45 | .. |
| 9 | 16 | 98 | 4 |
| 10 | 35 | 73 | 12 |
| 11 | 21 | 30 | 24 |
| 12 | .. | 1 | 9 |
| 13 | .. | .. | 1 |

The ventral plates in the three forms range as follows:

| NUMBER OF VENTRALS IN A TRANSVERSE ROW | NUMBER OF SPECIMENS | | |
|--|---------------------|-----------------|-------------------|
| | <i>argus</i> | <i>barbouri</i> | <i>brenchleyi</i> |
| 12 | 1 | 2 | 16 |
| 13 | 8 | 15 | 3 |
| 14 | 30 | 44 | 9 |
| 15 | 1 | 7 | .. |
| 16 | .. | 5 | .. |

The labials anterior to the subocular are less variable in the three forms, but *brenchleyi* has five in 26 cases and six in 22, while in both *barbouri* and *argus* five is exceeded in a much smaller proportion of specimens.

Variation in the number of gulars bordering the last pair of chin-shields in contact has been examined, and differs in the three forms as follows:

| NUMBER OF SCALES | <i>argus</i> | <i>barbouri</i> | <i>brenchleyi</i> |
|------------------|--------------|-----------------|-------------------|
| 2 | 1 | 10 | .. |
| 3 | .. | 10 | .. |
| 4 | 13 | 45 | 3 |
| 5 | 15 | 23 | 10 |
| 6 | 28 | 12 | 6 |
| 7 | 13 | 1 | 5 |
| 8 | 3 | .. | 1 |
| 9 | 1 | .. | .. |

Comparative Table of Variation in Chinese *Eremias*

| Species | Sex | Dorsals Across Back | | | Ventrals From Groin to Collar | | | Length Leg/ Length Body | | | Length Tail/ Total Length | | |
|--|-----|---------------------|----------|------|-------------------------------|----------|------|----------------------------|----------|------|------------------------------|----------|------|
| | | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean |
| <i>Eremias przewalskii</i> (Mongolia) | ♂ | 6 | 50-56 | 53 | 6 | 31-35 | 33 | 6 | .51-.56 | .53 | 2 | .54-.56 | .55 |
| | ♀ | 4 | 49-60 | 52 | 4 | 31-37 | 34 | 4 | .47-.51 | .49 | 2 | .52-.57 | .54 |
| | ♂ | 11 | 40-47 | 43 | 11 | 26-29 | 28 | 11 | .59-.68 | .64 | 10 | .61-.67 | .63 |
| <i>Eremias brenckleyi</i> (Shansi) | ♀ | 14 | 38-45 | 42 | 14 | 27-32 | 28 | 14 | .55-.67 | .61 | 13 | .60-.65 | .62 |
| | ♂ | 35 | 42-54 | 48 | 35 | 28-34 | 31 | 33 | .49-.56 | .53 | 28 | .54-.59 | .57 |
| <i>Eremias (Mai Tai) Chao, Shansi</i> | ♀ | 26 | 43-54 | 47 | 26 | 30-34 | 33 | 26 | .43-.52 | .48 | 22 | .50-.56 | .53 |
| | ♂ | 8 | 48-52 | 50 | 8 | 27-32 | 28 | 8 | .55-.61 | .58 | 5 | .56-.68 | .63 |
| <i>Eremias (Chen Tzu, Taiyu-an, Shansi)</i> | ♀ | 11 | 45-55 | 49 | 11 | 28-32 | 30 | 11 | .50-.64 | .55 | 7 | .55-.62 | .58 |
| | ♀ | 7 | 44-47 | 46 | 7 | 29-31 | 30 | 7 | .45-.56 | .51 | 6 | .53-.56 | .54 |
| <i>Eremias (Ningwu, Shansi) arpus</i> (Chibbi) | ♂ | 10 | 54-66 | 57 | 10 | 29-32 | 31 | 10 | .52-.56 | .54 | 8 | .57-.61 | .59 |
| | ♀ | 30 | 48-65 | 56 | 30 | 28-34 | 31 | 30 | .43-.55 | .48 | 28 | .52-.57 | .54 |

Variation in dorsal and ventral counts and in measurements is shown in the comparative table.

In juvenile specimens the lateroventral line is continuous, straight-sided, and has a broad, lateral, dark brown band above it; the dorso-lateral line is nearly continuous; the white spots of the dorsal series are very small and without black borders; they may be absent or may be represented by faint continuous lines. In medium-sized and adult specimens the mid-dorsal area tends to be uniform olive, or with scattered small black spots. The white spots are faint, when present, except in No. 31403, in which they are well defined; strap-shaped transverse black bars, characteristic of *barbouri*, are present in only a single specimen. The single Chen Tzu specimen has the typical *brenchleyi* coloration, a low dorsal scale count (44), and the subocular bordering the lip.

Scincidæ

Mabuya multifasciata (Kuhl)

Two specimens, A. M. N. H. No. 20984 and 20985, are from the Mom Ting River, Burma Border of Yunnan, March, 1917, collected by R. C. Andrews and Edmund Heller.

These two specimens agree in all essential characters with the series from Hainan, reported upon in a former paper.

Sphenomorphus indicus (Gray)

Eight specimens of this lizard come from widely distributed localities: A. M. N. H. No. 17459, Changsha, Hunan, July, 1921, J. W. Williams; 18610, 18613, 20991, near Yenping, Fukien, August 5, 1920, H. R. Caldwell; 20988-20989, Tengyueh, Yunnan, May, 1917, R. C. Andrews and Edmund Heller; and 23555 and 23588, Yenchingkau, Szechwan, October, 1921, Walter Granger.

These specimens exhibit some geographic variation, but the series are insufficient for definite conclusions as to the recognition of local races. The specimen from Changsha has the lateral band broken into vertical bars, much as in *L. zebratum* Boulenger, which Boulenger himself refers to *S. indicus*. The two Yunnan specimens have longitudinal black lines on the mid-dorsal brown area, which are absent in Fukien and Szechwan specimens, but such lines reappear in Formosan specimens (Stejneger, 1907, p. 216). The Yunnan and Szechwan specimens have 37-38 scales around mid-body, the Hunan and Fukien specimens 34-36. Werner, however, (1910, p. 43), records a Fukien specimen with 38 scales around the body.

***Lygosaurus sowerbyi* Stejneger**

A single specimen. A. M. N. H. No. 23610, Fukien Province, 1921, collected by H. R. Caldwell, is in the collection.

This specimen, the second known, is notably larger than the type.

It has 30 scales around the body: 45 scales from base of tail to the parietals; 51 ventrals from anus to chin shields; 6 upper labials; 9 supraciliaries; 15-16 lamellæ beneath the fourth toe; body length, 76 mm.; hind leg, 22 mm.; leg/body, .29.

***Leiopisma monticola*, new species**

Figure 5

TYPE.—A. M. N. H. No. 20998; Snow Mountain Village, 9000 feet altitude, Likiang, Yunnan, China; November, 1916; R. C. Andrews and Edmund Heller.

DIAGNOSIS.—Body elongate, limbs weak, separated when adpressed by the length of the arm; digits 5; head wider than the neck; an undivided transparent shield in the lower eyelid; no supranasals; ear opening without denticles; dorsal

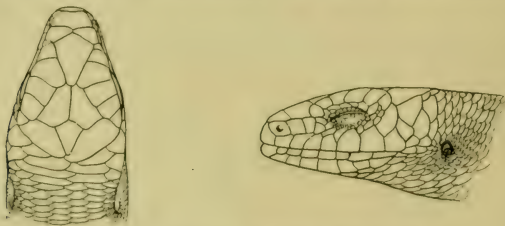


Fig. 5. *Leiopisma monticola*, new species.

Dorsal and lateral views of head of type, $\times 3$.

scales smooth, slightly larger than the ventrals, in 24 rows around the body; a pair of enlarged preanals; anterior loreal longest; frontal in contact with the anterior two supraoculars; front parietals larger than the interparietal; 12 lamellæ beneath the fourth toe; back light brown, with rows of darker spots; sides dark brown; venter very dark gray.

DESCRIPTION OF TYPE.—Habitus elongate, limbs weak, separated when adpressed by the length of the arm; digits 5; head wider than the neck; ear opening small.

Rostral wider than high, broadly in contact with the frontonasal; frontonasal twice as broad as long; prefrontals meeting in a point behind the frontonasal; frontal kite-shaped, in contact with the two anterior supraoculars; frontoparietals larger than the interparietal; parietals meeting behind the interparietal; three pairs of enlarged nuchals; four supraoculars and small latero-posterior one; second supraocular largest; seven supraciliaries; nostril pierced in a single nasal; seven upper labials; anterior loreal largest.

Dorsal scales perfectly smooth, in twenty-four rows around the body, seventy from a point opposite the posterior border of the thighs to the parietals; two strongly enlarged preanals; twelve lamellæ beneath the fourth toe.

General ground color light brown; a dorsolateral light line, outlined above by a nearly continuous row of dark spots, below by solid brown, which lightens toward the belly and continues as a lateral line to the end of the tail; two somewhat discontinuous rows of dark spots on the middle of the back suggest the presence of a vertebral lighter line between them; upper surface of tail with dark spots; venter very dark gray.

The type measures 136 mm. from snout to tip of tail, the body composing 55 mm. and the tail 81; the arm measures 9 mm., the leg 12 mm.

NOTES ON PARATYPES.—In four male paratypes, A. M. N. H. Nos. 20996–20997, 20999–21000, from the type locality, the scales around the body are uniformly 24, and range from 66 to 78 from parietals to thigh. The subdigital lamellæ beneath the fourth toe are ten in two counts, eleven in three, and twelve in three. The prefrontals are in contact in two specimens, narrowly separated in one, and well separated in one. A single female specimen, A. M. N. H. No. 20995, from Snow Mountain at timberline, 13,000 feet altitude, has twenty-six scales around the body and a decidedly more elongate habitus, with a minute ear opening. These differences are in part accountable as sexual, perhaps in part due to variation in the 4000 feet of altitude difference.

This form differs from *Leiolopisma potanini* (Günther), (1896, p. 204), in having fewer scales around the body and fewer subdigital lamellæ. The latter character is unknown for *L. exigua* (Anderson), from Tengyueh, but *exigua* is said to have twenty-eight scales around the body, and is geographically remote from northern Yunnan. *L. sikkimense* seems to be allied to the present form, but it has 16 to 19 subdigital lamellæ and a much less elongate body.

***Leiolopisma modestum* (Günther)**

Seventy-seven specimens are referred to this species: A. M. N. H. Nos. 23635–23650, Wanhsien, Szechwan, and 23651–23710, Chin Chow, Szechwan, collected by Walter Granger, 1921; and 23567, Huping College, Yochow, Hunan, spring of 1922, collected by Clifford H. Pope.

These specimens differ from the form of southern China, regarded as *reevesii* by me, in having fewer scale rows around the body, fewer dorsal scales in a longitudinal row, fewer subdigital lamellæ, and in having the prefrontals usually in contact, besides being strikingly different in coloration. I do not think that *modestum* is to be thought of as subspecifically related to *reevesii*, and it is certainly much more closely related to the North American *laterale* than to *reevesii*.

The type locality of *L. modestum* is Ningpo, and it is unfortunate that there is no topotypic material at hand for comparison with the Szech-

wan series under consideration. I do not believe, however, that the *Leiopismas* of the Lower Yangtze Valley will be found to differ from those of Szechwan.

The present series agrees with *septentrionale* and differs from *reevesii* in having a scalloped dorsal margin of the lateral brown band, and in having this band unbroken by light spots. The American *L. laterale* has a straight lateral band, lineate sides, and differs from *modestum* in the average values of scale characters. These relations are shown in the accompanying table of scale characters and measurements of the Chinese *Leiopismas*, in which the Formosan and Rui Kiu species are included as far as available data permits.

***Leiopisma septentrionale*, new species**

Figure 6

TYPE.—A. M. N. H. No. 21451; Hsing Lung Shan, Eastern Tombs, Chihli Province; August, 1921; Clifford H. Pope.

DIAGNOSIS.—Body elongate, limbs failing to meet by half the length of the arm; digits five; head wider than the neck; an undivided transparent shield in the lower eyelid; no supranasals; ear-opening without denticles; dorsal scales smooth, in 28 rows around the body; a pair of enlarged preanals; anterior loreal smaller than

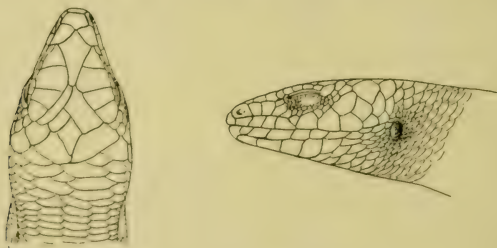


Fig. 6. *Leiopisma septentrionale*, new species.

Dorsal and lateral views of head of type, $\times 3$.

the second; fourteen or fifteen lamellæ beneath the 4th toe; sides dark brown, back light metallic brown, the dorsolateral line where the two colors meet regularly scalloped, not straight; throat lighter than the venter, with brown spots.

DESCRIPTION OF TYPE.—Body elongate, not depressed; limbs failing to meet by half the length of the arm; digits normal; head broader than the neck; ear opening larger than the transparent shield in the lower eyelid.

Rostral and frontonasal in broad contact, frontonasal broader than long, in contact with the frontal in a point; prefrontals moderate, barely meeting in front of

the frontal; frontal kite-shaped, nearly as long as the frontoparietals and interparietals frontoparietals unequal, one nearly twice as large as the other; a small extra shield cut off from the interparietal; parietals forming a suture behind the interparietal; three pairs of broad nuchals; four supraoculars, the frontal in contact with the anterior two; six supraciliaries; anterior loreal smaller than the posterior; eight upper labials; temporals 2-2-3, the upper anterior smallest, the lower second, lower anterior, and upper second, in order of increasing size.

Twenty-eight smooth scales around the body mid-way between the limbs; 67 dorsal scales from the parietals to the posterior face of the thighs; seventy-eight ventrals from the postmental to the preanals; enlarged preanals as long as broad; fifteen smooth lamellæ under the fourth toe.

Back light metallic brown, covering the six dorsal scale rows and the adjacent half rows; sides dark brown sharply outlined above, less distinctly set off from the dark gray below; dorsolateral line, where the dorsal and lateral colors meet not straight, rather regularly scalloped; sides gray, with scattered brown spots; venter lighter gray; throat and lower labials light, spotted with brown; black spots forming fairly regular longitudinal rows on the light brown of the back.

Measurements:

| SEX | A. M. N. H. No. | 21450 (PARATYPE) |
|-----------------|-----------------|------------------|
| | 21451 (TYPE) | |
| Snout to Anus | 55 mm. | 46 |
| Snout to Ear | 10 | 9 |
| Snout to Arm | 16.5 | 15.5 |
| Axilla to Groin | 33 | 29 |
| Arm | 12 | 10 |
| Leg | 16 | 14 |

NOTES ON PARATYPE.—The single paratype, also from Hsing Lung Shan, agrees in every respect with the type. It has 28 scales around the body; 67 from the parietals to the posterior face of the thighs; and fourteen lamellæ beneath the fourth toe.

When first described, I had compared this species primarily with *Leiopisma reevesii* of southern China and with *L. laterale* of the southeastern United States. The subsequent examination of the large series of *L. modestum* from Szechwan (described above) proves that *septentrionale* is most closely allied to *modestum* to which it is also nearest geographically. I believe it to be well distinguished from *modestum* by its more elongate body. Additional material of this form is much to be desired for further comparison with both *modestum* and *laterale*.

***Leiopisma barbouri* Stejneger**

Figure 7

A. M. N. H. No. 22695, Yunnanfu, Yunnan, and 12803, Wutingchow District, Yunnan, collected by John Graham, represent this recently described form.

DIAGNOSIS.—Head notably small, limbs short, body and tail elongate; scales around body 24–26; subdigital lamellæ of the 4th toe 14–16; no white spots interrupting the lateral dark band; black borders of the dorsal scales forming a feather-stitch pattern; prefrontals separated.

DESCRIPTION OF A. M. N. H. No. 22695.—Body elongate, somewhat compressed, limbs short, separated when adpressed by the length of the leg; head proportionately small; tympanum well developed nearly as large as the eye-opening; tail stout, slightly compressed, slightly constricted at its base.

Rostral broadly in contact with the frontonasal; frontonasal wider than long, narrowly in contact with the frontal; prefrontals narrowly separated, in contact with two loreals; frontal kite-shaped, about once and a half as long as broad; frontoparietals and interparietal subequal; parietals oblique, in contact behind the interparietal;



Fig. 7. *Leiolopisma barbouri* Stejneger.

A. M. N. H. No. 22695, Dorsal and lateral views of head, $\times 3$.

enlarged nuchals 3–4, the first pair wedge-shaped; four large supraoculars followed by a small one between the last supraciliary and the parietal; seven supraciliaries; a few small postoculars, followed by four temporals of which the upper anterior is smallest and the upper posterior largest; anterior loreal higher than the second; dorsal scales smooth slightly smaller on the sides, 26 around the body, 68 in a line from parietals to thighs; 77 ventrals from anal cleft to chin; two enlarged preanals; 15 and 16 lamellæ beneath the fourth toes.

General color olive-green, heavily maculate with black on back, sides, and venter, especially at the angles of the scales; throat with parallel dark lines, less distinct on the belly; a dark dorsolateral band from the end of the snout to the end of the tail (absent on the reproduced tip).

Measurements:

| | |
|-----------------------|--------|
| Body | 48 mm. |
| Arm | 8 |
| Leg | 12 |
| Shielded part of head | 7 |

This form may prove to be near *L. potanini*. The latter is very close to what I have called *modestum* in the present paper. It is certainly possible that *potanini* and my *modestum* may prove the same, but the Yunnan form here described is certainly distinct from our Szechwan series.

Comparative Table of Variation in Chinese *Leiopisma*

| Species | Sex | Scales Around Body | | | Dorsal Scales in a Longitudinal Row | | | Lamellæ Beneath 4th Toe | | | Length Leg/Length Body | | | Length Tail/Total Length | | |
|---|-------|--------------------|----------|------|-------------------------------------|----------|------|-------------------------|----------|------|------------------------|----------|------|--------------------------|----------|------|
| | | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean |
| <i>Leiopisma laterale</i> (North America) | ♂ + ♀ | 33 | 26-30 | 27.0 | 33 | 61-75 | 68 | 38 | 15-20 | 17 | 10 | 29-37 | 32 | 7 | 59-66 | 62 |
| • <i>modestum</i> (Szechwan) | ♂ | 15 | 26-30 | 28.1 | 15 | 57-67 | 62 | 30 | 13-17 | 15 | 15 | 30-37 | 34 | 10 | 59-63 | 61 |
| | ♀ | 15 | 28-30 | 28.9 | 15 | 59-72 | 65 | | | | 15 | 29-33 | 32 | 10 | 58-62 | 60 |
| <i>septentrionale</i> (Chihli) | ♂ | 2 | 28 | 28.0 | 2 | 67 | | 2 | 14-15 | 14.5 | 2 | 29-30 | 29.5 | | | |
| <i>formosensis</i> (Formosa) | ♂ + ♀ | 19 | 26-30 | 27.2 | 19 | 53-65 | 58 | 4 | 14-17 | | | | | | | |
| <i>bettgeri</i> (Ishigakishima) | ♂ + ♀ | 26 | 28-32 | 29.2 | 26 | 59-66 | 63 | | | | | | | | | |
| <i>vanderburghi</i> (Tsushima) | ? | 1 | 28 | 28.0 | 1 | 69 | 69 | 1 | 12 | 12 | | | | | | |
| <i>reevesii</i> (Hainan) | ♂ | 18 | 30-32 | 30.4 | 18 | 66-74 | 70 | 18 | 16-19 | 18 | 18 | 31-37 | 34 | 10 | 63-67 | 65 |
| <i>barbouri</i> (Yunnan) | ♀ | 9 | 30-33 | 31.2 | 9 | 69-76 | 73 | 9 | 17-19 | 18 | 9 | 28-33 | 31 | 4 | 62-64 | 63 |
| <i>monticola</i> (Yunnan) | ♂ + ♀ | 4 | 24-26 | 25.0 | 4 | 68-74 | 72 | 4 | 14-16 | 14.5 | 3 | 25-28 | 27 | | | |
| <i>exigua</i> (Yunnan) | ♂ + ♀ | 6 | 24-26 | 24.3 | 6 | 66-78 | 72 | 6 | 10-12 | 11 | 6 | 18-26 | 23 | 1 | 60 | 60 |
| <i>potanini</i> (Szechwan) | ? | 1 | 28 | 28.0 | | | | 1 | 17 | 17 | 1 | 31 | 31 | | | |
| | ? | 1 | 27 | 27.0 | | | | | | | | | | | | |

***Leiolopisma doriae*, Boulenger**

Two specimens from Yunnanfu, Yunnan, A. M. N. H. Nos. 9123 and 12786, collected by John Graham, are referred to this species with some hesitation. They have 30-32 scales around the body instead of 26-28, but otherwise agree with Boulenger's description. Comparison material of the *Leiolopismas* of Upper Burma and western Yunnan is required for the satisfactory determination of the species in this area.

***Eumeces pekinensis* Stejneger**

Twelve specimens, A. M. N. H. Nos. 21452-21463, collected at Hsing Lung Shan and 13 miles north of Hsing Lung Shan, Eastern Tombs, Chihli, August, 1921, by Clifford H. Pope.

Two very distinct color phases, connected by intermediate specimens, are represented in the present series. Six specimens are black above with five narrow white lines, a vertebral, a pair of dorsolateral on the third row, and a lateral on the fifth and sixth rows, passing through the ear; the lower line is black-bordered below; the vertebral line forks at the interparietal and outlines this shield and the frontal. The dorsolateral lines extend on the supraciliary border to the canthus; the three upper lines extend on the base of the tail; venter dark gray, throat lighter.

The second color-phase is represented by three specimens which have the two and a half scale rows on each side of the vertebral line uniform greenish olive; a black lateral band on the next $1\frac{1}{2}+1+1\frac{1}{2}$ scale rows, below which is the light lateral line; the lateral line is faint because its black lower border is narrow and interrupted. Head brownish olive above.

The transitional stages between the two patterns are represented by three specimens. The two broad dark dorsal bands become lighter until they are represented by narrow black lines which outline the position of the light lines, while the latter come to be of the same shade as the new dorsal ground color.

The upper labials are seven in eleven specimens, six in one. The supraciliaries range from six to eight. The lamellæ beneath the fourth toe are fifteen or sixteen. The scales around mid-body are 24 in two, 23 in two, and 22 in eight specimens. The dorsal scales from the posterior border of the thighs to the parietals vary only from 52 to 58, averaging 55.

The largest specimen measures 210 mm. of which the tail occupies 130 mm. The length of the hind leg averages 0.39 of the body length. The tail length (in seven specimens) averages 0.60 of the total.

"Three skinks were found August first, each in a burrow with eggs. The burrows were under two rather large stones on a rocky hillside, within ten feet of each other. In each case, a part of the burrow extended beyond the stone into the soil, while the eggs were spread out in the portion exposed by lifting the rock. The burrows were about twelve inches in length, two inches wide, and less than an inch in depth. Two nests contained four eggs each and the third eight. The eggs measured 11×15 mm. Their color was a uniform grayish brown.

"Persistent search on the same hillside, though at some distance from the three nests, failed to locate others. A single specimen, without eggs, was found in a burrow beside a stone on another hillside. On August fourth we returned to the site of the first nests found, and discovered three more, within a radius of a few feet, each with eggs, and guarded by a female skink. These three burrows were much like the first ones found, but were under small stones, which merely covered the opening. The eggs were immediately beneath the stone in two nests, distributed along the burrow in the third. The number of eggs in the several nests was four, seven and eight.

"These observations show that this species has a well-defined type of burrow, that the female remains with the eggs, and probably indicate that the breeding females assemble in small colonies." (C. H. P.)

Eumeces chinensis Gray

Six specimens, A. M. N. H. Nos. 20986-20987, from Futsing, Fukien; 23569-23570 from Yenping, Fukien; and 23609, from Fukien Province, the first two collected by R. C. Andrews and Edmund Heller, July, 1916, the remaining by H. R. Caldwell 1921; 23550, Yenchingkau, Wahnsien, Szechwan, collected by Walter Granger, October, 1921.

This series is compared in detail with the specimens referred to *E. pulcher*, under the discussion of the latter form.

Eumeces pulcher (Duméril and Bibron)

Seven specimens; A. M. N. H. Nos. 23557, Huping College, Yochow, Hunan, spring, 1922; and 31203-31207 and 31226, Ningkwo, Anhwei, September-October, 1921, all collected by Clifford H. Pope.

This series differs from the Fukien *chinensis* in a number of characters, each insufficient if taken alone, to warrant the distinction of a species (or subspecies) but amounting to conclusive evidence when taken together. The number of scales around the body is 24 in five, 25 in one, and 26 in one. In six *chinensis* 24 occurs in three, 26 in three. The

dorsals in a longitudinal row range from 48 to 53 in *pulcher*, from 50 to 53 in *chinensis*. The ventrals in *pulcher* range from 53 to 56, from 54 to 57 in *chinensis*. The upper labials in *pulcher* are 6 in ten counts, 7 in four, while in *chinensis* they are 6 in two cases and 7 in ten. The supraciliaries range from 7 to 9 in *chinensis* and from 6 to 9 in *pulcher*. The lamellæ beneath the fourth toe are uniformly 16 in *chinensis* and range from 13 to 17, with an average of 15, in *pulcher*. The average length of the hind leg, compared with that of the body (length of leg/body length), is much greater in *chinensis*:

| | SEX | NO. OF SPECI- MENS | EXTREMES | AVERAGE |
|------------------|-----|-----------------------|----------|---------|
| <i>chinensis</i> | ♂ | 4 | .37-.38 | .38 |
| | ♀ | 2 | .33 | .33 |
| <i>pulcher</i> | ♂ | 2 | .30 | .30 |
| | ♀ | 4 | .28-.33 | .31 |

In addition to the number of labials and the length of the leg, the two forms are decidedly different in coloration. None of the Fukien specimens show a trace of longitudinal dorsal lines, and they have scarcely any black markings on the sides. In the Ningkwo specimens adult male and female and juvenile color patterns are well represented.

In No. 31203, ♂, the back is uniform olive; head brownish above, especially on the temporal region and the snout; venter very light gray, extending well up on the sides; a diffuse dark band on the sides consisting chiefly of dark posterior margins of the scales of the fourth and fifth rows from the vertebral line; numerous scales on the anterior portion of the sides and especially on the neck, entirely pinkish orange; scales on the upper sides of the limbs with dark outlines.

In No. 31205, ♀, the venter is light gray, the anterior margin of each scale black; these black marks become faint on the throat and are absent on the chin; a pair of black dorsal lines, which occupy the outer half of the first scale row and the inner half of the second (counted from the vertebral line) outline three olive dorsal lines, of which the vertebral is the most sharply defined; the black lines consist of nearly confluent black spots; top of head uniform olive with a few faint black markings; sides largely black but with numerous light spots on the anterior margins of individual scales; labials outlined with black; limbs largely black above.

No. 31226, juvenile, is coal black above, very dark gray below; vertebral light line sharply defined and continuous; dorsolateral lines slightly interrupted; sides with a number of light spots, not arranged in

a definite row; top of head olive, clouded with black; upper and lower labials with very distinct white spots.

The juvenile color pattern was described by Duméril and Bibron, the type of *pulcher* having been a juvenile specimen. As the type locality of neither *pulcher* nor *chinensis* was fixed more closely than "China" in the original descriptions, I have adopted the two names in the sense of Duméril and Bibron, who are the first revisors. Cantor's *Tiliqua rufoguttata*, type locality Chusan, is evidently a synonym of *pulcher*.

The specimens from Hunan and Szechwan, referred respectively to *pulcher* and *chinensis*, are somewhat unlike the Ningkwo and Fukien series, and are indistinguishable in scale characters from each other. They have been assigned to their respective species on the basis of coloration and geographic probability. It seems highly probable that additional collections will make it possible to unite these two forms as subspecies of *chinensis*.

Eumeces elegans Boulenger

Forty-nine specimens represent this species: A. M. N. H. Nos. 17422, collected at Changsha, Hunan, July, 1921, by J. W. Williams; 18612, 20992, 23571-23583, near Yenping, Fukien, and 23611-23612, Fukien Province; 22696, Yunnanfu, Yunnan, collected by John Graham; 20993-20994, Yunnan Province, collected by R. C. Andrews and Edmund Heller, 1916-1917; 23587, Wanhsien, Szechwan, December, 1921, collected by Walter Granger; and 23566, 31208-31225, and 31227-31234, Ningkwo, Anhwei, collected by Clifford H. Pope, September-October, 1921.

This series is remarkably uniform and presents no evidence of geographic variation.

SERPENTES

Typhlopidae

Typhlops braminus (Daudin)

A single specimen, A. M. N. H. No. 23490, represents this species in the present collection. It was collected near Yenping, Fukien Province, 1921, by H. R. Caldwell.

The interesting note by Robert Mell (1922, p. 114) that this species is frequently found in flower pots throws light on the mode of dispersal of this singularly distributed form. It is quite as singular that no other species of *Typhlops* exhibits a similar erratic distribution.

Colubridæ

Sibynophis collaris chinensis (Günther)

Three male specimens of this form are in the collection: A. M. N. H. Nos. 18615, mountains near Yenping, Fukien Province, August, 1916, R. C. Andrews and Edmund Heller; 23493, Fukien Province, 1921, H. R. Caldwell; and 21471 "China," purchased at Hsing Lung Shan, Chihli, 1921, by Clifford H. Pope.

The two Fukien specimens each have 182 ventrals, and 104 and 108 caudals respectively. The specimen without locality has 168 ventrals and 106 caudals. No. 18615 has the lower anterior temporal extended to the labial border, thus constituting an extra labial, i.e., labials 10-10, instead of 9-9, as in the other specimens. In all three the dorsal scales are in 17 rows from head to tail; the 4th, 5th, and 6th labials enter the eye; the lower labials are 9; the pre- and postoculars are 1-2; and temporals 2-2, except in the anomaly noted above. No. 23493 measures 694 mm., the tail amounting to .31 of the total length. A fourth specimen, from Changsha, Hunan, has 182 ventrals and 103 caudals.



Fig. 8. *Sibynophis grahami* (Boulenger)
Dorsal and lateral views of head of A. M. N. H. No. 12804, $\times 2$.

Sibynophis grahami (Boulenger)

Figure 8

Two specimens of this species, A. M. N. H. Nos. 18080 and 12804, from Yunnanfu and Wutingchow, Yunnan, in the Graham collection, are in the American Museum. These agree with Boulenger's description (1904, p. 132) in coloration. Their ventral counts are 188 and 194; tails incomplete.

***Natrix æquifasciata* Barbour**

Figure 9

A single male specimen of this striking species, A. M. N. H. No. 21037, Futsing, Fukien, R. C. Andrews and Edmund Heller, July, 1916.

The dorsal scale count is 21-19-17, ventrals 151, anal divided, subcaudals 76. The dorsal scales are without pits, all strongly keeled except the outer row, which is faintly keeled. The maxillary teeth are 26, subequal. The internasals are narrowed anteriorly, their suture with the rostral less than that of rostral and first labial. Upper labials 9. One preocular, 3-4 postoculars, and 2-3 very small suboculars, which exclude

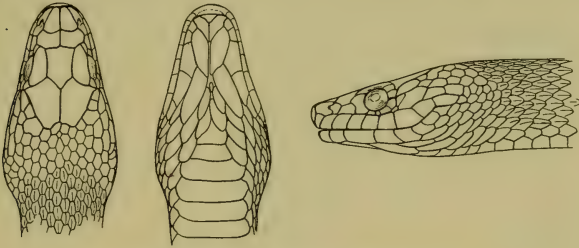


Fig. 9. *Natrix æquifasciata* Barbour.

Dorsal, ventral, and lateral views of head of A. M. N. H. No. 21037, natural size.

the labials from the eye. Lower labials 9-10. Temporals 4-3-3 and 2-3-4, two of the first row on the side with four being very small. The total length is 813 mm. of which the tail constitutes .23.

The top and sides of the head, including the labials, are uniform dark brown. Back brown, with broad transverse dark bands which join the more strongly marked quadrangular black blotches of the venter. These bands are hourglass-shaped on the sides and dorsally are split with a short transverse light marking. The ventral black marks are mostly offset on the mid-ventral line. Ventral ground color yellowish, clouded with brown posteriorly; lower labials clouded with brown, chin-shields like the venter. Twelve black marks beneath the tail.

Barbour's types of this species were two juvenile specimens from Hainan. The specimen above described differs chiefly in the presence of the suboculars, and in the less distinct color pattern. Even in the two types, however, the oculars are highly variable, and the pattern difference appears to be an age character. In habitus and general features of both

scaling and coloration, *Natrix equifasciata* appears to be allied to *Natrix annularis* and *percarinata*.

***Natrix annularis* (Hallowell)**

Thirty-two specimens of this species as follows: A. M. N. H. Nos. 18617, Fukien Province, March 18, 1921, H. R. Caldwell; 23525, 23530, 23532, 24626-24630, Wuhu, Anhwei, September-October, 1921, C. H. Pope; 24527-24528, 24568-24577, 24596-24606, Ningkwo, Anhwei, September-October, 1921, C. H. Pope.

In this series the dorsal scales are uniformly 19-17. The upper labials are normally 9, 8 occurring five times and 10 twice, in which cases the 4th and 6th labials, respectively, enters the eye, instead of the 5th. Lower labials 10, rarely 9. Pre- and postoculars invariably 1-3. Temporals normally 2-3, 1-3 occurring fourteen times.

No. 24597 gave birth to nine young September 28, 1921. One of these is a monster, grown together where it was doubled upon itself in the egg-membrane and with a projecting lower jaw.

Summary of Measurements and Scale Characters¹

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|----------------|-----|---------------------|-------------|---------|
| Ventral Plates | ♂ | 5 | 152-159 | 156 |
| | ♀ | 12 | 149-153 | 151 |
| Subcaudals | ♂ | 3 | 61- 68 | 64 |
| | ♀ | 10 | 51- 62 | 59 |
| Total Length | ♂ | 3 | 381-541 mm. | 477 mm. |
| | ♀ | 10 | 407-837 mm. | 654 mm. |
| Tail/Length | ♂ | 3 | .20-.22 | .21 |
| | ♀ | 10 | .20-.22 | .21 |

***Natrix percarinata* (Boulenger)**

Six specimens in the collection belong to this species: A. M. N. H. Nos. 21036, Futsing, Fukien, July, 1916, R. C. Andrews and Edmund Heller; 23491, Fukien Province, H. R. Caldwell, 1921; 23522, Yenping, Fukien, H. R. Caldwell, 1921; 23498-23499, Yenchingkau, Wanhhsien, Szechwan, October, 1921, Walter Granger; and 23538, bought at Wuhu, Anhwei, by Clifford H. Pope, 1921.

The two Szechwan specimens, a male and female, each have 139 ventrals and 71 caudals. In the Fukien specimens the ventrals range from 138 to 143, the caudals from 70 to 74. No. 21036 has the dorsal scale formula 19-21-17, 19-17 in the others. One specimen has eight

¹Adult specimens from Wuhu and Ningkwo.

upper labials, nine in the rest; lower labials uniformly ten; preocular single in all: postoculars four or five; anterior temporals two except in a single specimen, which has one on one side; second row of temporals usually three, four in one case. The largest specimen, No. 23499, ♀, measures 964 mm. The tail length in the series varies from .25 to .27 of the total.

This species is evidently allied to *Natrix annularis*. The juvenile coloration is much more sharply defined than in the adult, and the dorsal crossbands are split with a white line as in *N. æquifasciata*. These three forms therefore compose a closely connected group although there is no doubt that they are to be retained as fully distinct species.

The record from Szechwan is a great extension of the range of this species, which has hitherto been known from Fukien and Hainan. It has recently been recorded from Indo-China by Parker (1925, pp. 302, 304).

***Natrix piscator* (Schlegel)**

Three specimens, A. M. N. H. Nos. 21038, 21039, and 21042, from Futsing, Fukien, July, 1916, R. C. Andrews and Edmund Heller.

This species seems to reach the northern boundary of its range in southern Fukien. The Fukien specimens are in excellent agreement with the Hainan series of which I have given an account elsewhere.

***Natrix sancti-johannis* Boulenger**

Two specimens, A. M. N. H. Nos. 21070, 21071, Mom Ting River, Yunnan, March, 1917, R. C. Andrews and Edmund Heller.

This species is apparently new to China, and must be supposed to have entered via the tropical river valleys from Burma. It has previously been known from northern and central India.

Scale Characters and Measurements

| A. M. N. H. Nos. | 21070 | 21071 |
|------------------|----------|---------|
| Sex | ♀ | ♂ |
| Dorsal Scales | 21-19-17 | 19-17 |
| Ventrals | 151 | 143 |
| Subcaudals | 78 | 86 |
| Upper Labials | 9 | 9 |
| Lower Labials | 10 | 10 |
| Preoculars | 1 | 1 |
| Postoculars | 3 | 3-4 |
| First Temporals | 2 | 2 |
| Second Temporals | 2-3 | 1-3 |
| Total Length | 730 mm. | 805 mm. |
| Tail/Length | .26 | .30 |

Natrix craspedogaster (Boulenger)

Four specimens in the collection: A. M. N. H. Nos. 18614, 21018, 21019, Mountains near Yenping, Fukien, summer, 1916, R. C. Andrews and Edmund Heller; 23528, bought at Wuhu, Anhwei, by Clifford H. Pope, 1922.

These specimens agree excellently with Boulenger's description and figure. The dorsal scales are uniformly 19-17; the ventrals range from 144 to 150 (without sex distinction); the subcaudals are 82-89 in two females, 91 in the two males; upper labials 8, with a single exceptional 9; lower labials 10, with an exceptional 11; preocular uniformly single; postoculars 3, except in one specimen which has 3-4. The temporals, due to the height of the seventh labial, show an evident tendency to reduction in the second row; they are 1-0, 2-2-3, 2-1-2, and 1-1-2 in the four specimens. No. 18614 has two loreals on each side. The maximum size is attained by the Wuhu specimen, a female, 516 mm. in length. The tail length ranges from .29 to .31 of the total.

Natrix stolata (Linnæus)

Ten specimens, A. M. N. H. Nos. 21016-21017, Yenping, Fukien, summer, 1916, R. C. Andrews and Edmund Heller; 21029-21032, 21040, 21041, Futsing, Fukien, R. C. Andrews and Edmund Heller, July 28, 1916; 23492, Fukien Province, H. R. Caldwell, 1921; and 23526, bought at Wuhu, Anhwei, by Clifford H. Pope, 1922.

There is more black on the outer ends of the ventrals in this series than in the Hainan series which I have recently examined. The examination of Wall's figure (1911, Pl. xiv) indicates that the yellow neck, which is so characteristic of the Hainan and Kwangtung specimens of this species, is unknown in Indian specimens.

Summary of Scale Characters and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|----------------|-----|---------------------|-------------|---------|
| Ventral Plates | ♂ | 3 | 146-157 | 150 |
| | ♀ | 7 | 143-157 | 149 |
| Subcaudals | ♂ | 2 | 75-76 | 75.5 |
| | ♀ | 5 | 69-79 | 73 |
| Length | ♂ | 2 | 495-507 mm. | 501 mm. |
| | ♀ | 5 | 309-650 mm. | 534 mm. |
| Tail/Length | ♂ | 2 | .25-.26 | .255 |
| | ♀ | 5 | .24-.25 | .248 |

***Natrix tigrina lateralis* (Berthold)**

Fifty-two specimens of this species are in the collection: A. M. N. H Nos. 23501, 23507, 23509, Yenchingkau, 1500 feet altitude, Wanh sien, Szechwan, October 1921, Walter Granger; 23506 Luanshikau, 3000 feet altitude, Wanh sien, Szechwan, September, 1921, Walter Granger; 24578-24593, 25548-25549, Ningkwo, Anhwei, September-October, 1921, C. H. Pope; 21476-21478, Hsing Lung Shan, Eastern Tombs, Chihli, August, 1921, C. H. Pope; 23935-23943, Mai Tai Chao, Shansi, May, 1922, C. H. Pope; 28268, 28314-28328, Chen Tzu, Taiyuan, Shansi, July-August, 1922, C. H. Pope; 28335, Niangtzekwan, Shansi, September, 1922, C. H. Pope; 24623, Tsing Ling Mts., Shensi, 1922.

I am unable to find characters of any importance to distinguish the Szechwan series from eastern or northern specimens. The chief characters of the Anhwei series may be compared with those of the North Chinese specimens from Chihli, Shansi, and Shensi in the following two tabulations:

Summary of Scale Character and Measurements

| | SEX | No. OF SPECIMENS | EXTREMES | AVERAGE |
|-----------------------------------|-----|---------------------|-------------|---------|
| Anhwei Series | | | | |
| Ventral Plates | ♂ | 13 | 144-154 | 151 |
| | ♀ | 5 | 151-155 | 153 |
| Subcaudals | ♂ | 12 | 59-65 | 62 |
| | ♀ | 5 | 50-58 | 55 |
| Length | ♂ | 12 | 451-692 mm. | 617 mm. |
| | ♀ | 5 | 538-670 mm. | 640 mm. |
| Tail/Length | ♂ | 12 | .21-.23 | .22 |
| | ♀ | 5 | .17-.19 | .18 |
| Chihli, Shansi, and Shensi Series | | | | |
| Ventral Plates | ♂ | 11 | 148-157 | 153 |
| | ♀ | 18 | 152-163 | 157 |
| Subcaudals | ♂ | 11 | 60-69 | 64 |
| | ♀ | 11 | 59-61 | 58 |
| Length | ♂ | 10 | 588-759 mm. | 671 mm. |
| | ♀ | 11 | 589-860 mm. | 727 mm. |
| Tail/Length | ♂ | 10 | .21-.23 | .215 |
| | ♀ | 11 | .18-.19 | .185 |

Many specimens of this species exhibit a tendency to an even number of scale rows on the neck, with a nuchal groove which suggests the much more pronounced one of *Natrix nuchalis*.

A specimen from Mai Tai Chao contained a large *Bufo raddei*.

"A small green and red 'tiger snake' caught at Chen Tzu gave an excellent exhibition of the behavior of this species when annoyed. It flattened the whole body, especially the neck, and the sides of the neck were drawn down until the angle below was a right angle, or less, and the skin above was tightly stretched over the vertebræ. Just behind the head the neck was strongly arched, to such a degree as to make a fold of loose skin appear under the head where head and neck meet. The head, held in this position, was raised from one to four inches from the ground. The body was thrown into varying but gracefully regular coils. This snake could not be induced to bite or strike, but when its body was pinched at any point it would turn and 'butt' with its nose, but not with any particular violence. Sometimes the head and arched neck would be thrown well back, and then its attitude was much like that of a cobra.

"This flattening of the neck brings into vivid contrast the alternate red and green bars of its sides, and gives the snake a highly venomous appearance." (C. H. P.)

***Natrix leonardi* Wall**

Six specimens, A. M. N. H. Nos. 21061-21064, 21068-21069, Tengyueh, Yunnan, May, 1917, R. C. Andrews and Edmund Heller.

The dorsal scales in this series range from 18-17-15 to 16-15; ventrals from 145 to 155, 155 in the single male specimen; caudals from 46 to 52 in the five female specimens, 64 in the male. The upper labials are uniformly six, the lower labials eight with an exceptional seven. All have a single preocular, and the postoculars are two or three. The temporals are 1-0-1 in one, 1-1 in three, and 1-2 in two. The length ranges from 444 mm. to 615 mm. The tail length is .23 of the total in the male specimen, and ranges from .17 to .20 in the female specimens.

The reddish or orange nuchal collar, interrupted on the two median scale rows, is a striking color character.

The type locality of this species is about opposite Tengyueh, in Burma. (Wall, 1923, p. 466.)

Parker (1925, p. 296) refers this species to *Natrix nuchalis* (Boulenger) after examining the variation in dorsal scale counts in a series from Tonkin, Burma, and Yunnan. He does not account for the differences in ventral count and coloration, and in fact the table of variation in dorsal scale rows seems to indicate a considerable degree of geographic differentiation. Steindachner (1914, p. 321, fig. 1) has examined a series of fourteen *Natrix swinhonis* from Formosa and proposes to unite *nuchalis* with *swinhonis*. The range of ventral counts given by him unfortunately

contains an error, so that it is impossible to tell whether the maximum for Formosan specimens is 155 or 165. The reddish nuchal collar apparently allies *swinhonis* and *leonardi*.

For the present I have accordingly retained four of the species with a nuchal groove as distinct, though they undoubtedly compose a "Formenkreis."

The origin of the nuchal groove may be dependent on some characteristic attitude. *Natrix tigrina* occasionally has an even number of scale rows on the neck, and Mr. Pope's field notes are instructive in this connection.

***Natrix nivalis*, new species**

TYPE.—A. M. N. H. No. 21021; ♀; Snow Mountain Village, at 9000 feet altitude, Likiang, Yunnan; November, 1916; R. C. Andrews and Edmund Heller.

DIAGNOSIS.—Directly derived from *Natrix nuchalis*, from which it is distinguished by the lower number of ventral plates, and a proportionately broad and short frontal. Dorsal scales weakly keeled, in 17 rows; ventrals 150–152; anal divided; subcaudals 43–54; upper labials 6, the fifth very large; one preocular; postoculars 1–3; temporals 1–1 or 1–2; general color dark olive brown, without markings at the base of the scales; venter dark gray, the median part black.

DESCRIPTION OF TYPE.—Habitus not specialized; head slightly distinct from the neck; eye moderate.

Rostral wider than high, well visible from above; internasals about as wide as long, shorter than the prefrontals; frontal nearly as broad as long, slightly longer than its distance from the rostral; parietals nearly as long as their distance from the rostral, truncate posteriorly; two nasals; loreal small, as high as long; one preocular; postoculars 1–2; upper labials five, the first with a notch indicating the fusion of two labials, the fourth very large, the second and third entering the eye; lower labials eight, four in contact with the anterior chin-shields; second pair of chin-shields longer than the first, divergent; temporals 1–1 and 1–2, the first elongate.

Dorsal scales with low keels, the two lower rows perfectly smooth anteriorly, in 18–17–15 rows. A well-defined nuchal groove, correlated with the even number of the scale rows, as in *Natrix nuchalis* and *N. leonardi*. Ventrals 152; anal divided; subcaudals 54.

Color uniform dark olive-gray above, without markings at the bases of the scales; venter lighter anteriorly, clouded with darker markings posteriorly, especially on the anterior borders of the ventrals; no trace of a nuchal collar; labials without markings.

The type measures 625 mm., of which the tail occupies .18.

NOTES ON PARATYPES.—The two paratypes, both female specimens, A. M. N. H. Nos. 21025–21026, come from the type locality. Both have a nuchal groove, scales without black markings, and a very large penultimate labial. The ventral counts are 150 and 151, the subcaudals 43 and 46. The upper labials are six in both. The postoculars are two in one and three in the other. The temporals are 1–1–2 in No. 21025, due to the division of the elongate first temporal. One has the scales in fifteen rows throughout, seven on one side and eight on the other anteriorly, the other has sixteen scale rows on the neck, fifteen posteriorly.

This species is evidently directly allied to *Natrix nuchalis*, whose type locality is Ichang. Besides the difference in the form of the frontal, the ventral scales are decidedly fewer in the Yunnan form.

Eight specimens from Yunnanfu and Wutingchow in the Graham collection support the distinction of *nivalis* from *nuchalis* on the ventral scale count, which ranges from 137 to 147. These specimens lack the reddish nuchal collar which apparently distinguishes *leonardi*. Yunnan specimens recorded by Werner (1924, p. 44), as *nuchalis* have a similar ventral count, 140 to 148, and thus agree with *nivalis*.

***Natrix handeli* (Werner)**

Figure 10

A. M. N. H. No. 21023, ♂, Likiang, Yunnan, R. C. Andrews and Edmund Heller, 1916.

The dark venter of our specimen, which is wholly black for its posterior third, differs from Werner's description (1924, p. 45), in which the venter of his specimen is said to be light. The present specimen

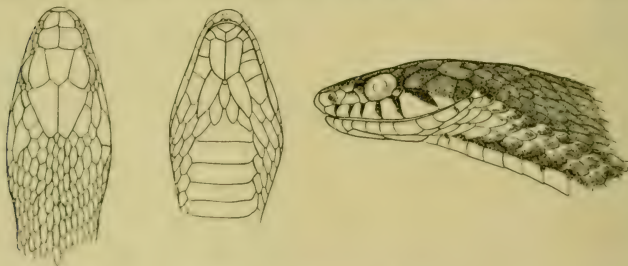


Fig. 10. *Natrix handeli* (Werner).

Dorsal, ventral and lateral views of head of A. M. N. H. No. 21023, natural size.

agrees in many details of scaling, in general features of coloration, and comes from the type locality, but differs in minor characters.

Dorsal scales 19-17-15, strongly keeled, the outer row smooth; ventrals 153; anal divided; subcaudals 65; upper labials 8, 4th and 5th, entering the eye; lower labials 9; oculars 1-3 on each side; temporals 1-2; length 755 mm., tail length .23. The maxillary teeth are 21+1, the last strongly enlarged. Dorsal scales with distinct apical pits. The internasals are subquadrate, their rostral suture greater than that of rostral and first labial.

The color is very dark brown above, loreal area and upper labials light brown; lower labials immaculate; sutures of the upper labials black, the seventh and eighth largely black; some square, obscure, light marks on the sides; throat and venter anteriorly light, with a well-defined longitudinal black line on the ends of the ventrals, beginning on the chin, but quickly merged into the increasing dark clouding of the venter; posterior third of the venter wholly black.

***Natrix helleri*,¹ new species**

Figure 11

TYPE.—A. M. N. H. No. 21049; ♀; Tengyueh, Yunnan, 5500 feet altitude; April 24, 1917; R. C. Andrews and Edmund Heller.

DIAGNOSIS.—Closely allied to *Natrix subminiata* of Java and southeastern Asia, from which it is distinguished by a higher number of ventral scales, 160–172, compared with 132–157 in *subminiata* as here restricted.

Dorsal scale rows 19, the outer smooth, the median rows sharply keeled; ventrals 163–172; anal divided; caudals 75–86; upper labials 7–9, three entering the eye; a single preocular; three postoculars; temporals 2–2; general color uniform olive, with reddish markings on the neck, chiefly confined to the skin between the scales.

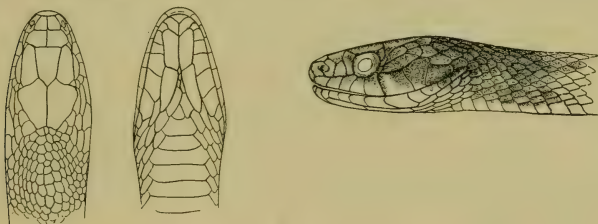


Fig. 11. *Natrix helleri*, new species.

Dorsal, ventral, and lateral views of head of type, natural size.

DESCRIPTION OF TYPE.—Habitus of *Natrix subminiata*. Nineteen subequal maxillary teeth, followed by two strongly enlarged ones. Rostral visible from above; internasals as long as broad, their sutures with the rostral subequal to those of rostral and first labial; internasals slightly shorter than the prefrontals; frontal slightly longer than its distance from the rostral, slightly shorter than the parietal suture; parietals truncate behind; frontal wider than the supraoculars; nasal divided; loreal higher than long; eight upper labials, sixth largest, seventh highest, and the third, fourth, and fifth entering the eye; ten lower labials; a single preocular; postoculars 2–3; temporals 2–2.

Dorsal scales in nineteen rows at mid-body, twenty-two on the neck, and seventeen near the tail, narrow, strongly keeled, and notched at the tip; outer scale row

¹Named for Mr. Edmund Heller, Assistant Curator of Mammals, Field Museum of Natural History.

smooth; a pair of faint scale pits, often difficult to discern; ventrals 169; tail incomplete.

General color uniform olive, with reddish markings on the neck, chiefly confined to the skin between the scales; lower labials cream; upper labials gray anteriorly and posteriorly, the middle ones lighter, with a black mark on the 5th-6th suture.

NOTES ON PARATYPES.—The five paratypes agree in general with the type; No. 21047, ♀, from the type locality, has 21-19-17 dorsal scales; 165 ventrals; 83 subcaudals; labials 7-8; oculars 1-3; and temporals 2-3. This specimen measures 860 mm., the tail occupying .23 of the total. No. 21048 is from Yungchang, Yunnan; it agrees with the type in having an even number of scale rows on the neck, (twenty); ventrals 172; tail incomplete; labials 8-9; otherwise in complete agreement with the type.

A specimen from Yenping, Fukien, A. M. N. H. No. 23533, ♂, collected November 25, 1921 by H. R. Caldwell agrees excellently with the Tengyueh specimens. It has 172 ventrals, 83 caudals, upper labials 8, lower labials 10, oculars 1-3, and temporals 2-2 and 2-3. The characteristic coloration of the upper labials is present.

Two specimens from the Wutingchow District, Yunnan, collected May 3, 1919 by John Graham, may be placed here. Their ventrals are 160-161, caudals 73-80.

This species has, of course, long been known simply as *Natrix subminiata*; its ventral count is quite different, however, and does not even overlap that of its relative in southeastern Asia, of which considerable numbers are now on record.

***Natrix parallela* (Boulenger)**

Two specimens, A. M. N. H. Nos. 21022 and 21024, collected at Likiang, Yunnan, October, 1916, by R. C. Andrews and Edmund Heller, are tentatively referred to this form. Their scale characters and measurements are as follows:

| A. M. N. H. Nos. | 21022 | 21024 |
|-------------------|--------------|---------|
| Sex | ♀ | ♂ |
| Dorsal Scales | 19-17 | 19-17 |
| Ventrals | 170 | 169 |
| Caudals | 69 | 73 |
| Upper Labials | 8 | .. |
| Lower Labials | 9-11 | .. |
| Preoculars | 1-1 | .. |
| Postoculars | 3-3 | .. |
| Temporals | 2-1-2, 2-1-3 | 2-2 |
| Total Length | 595 mm. | 488 mm. |
| Tail/Total Length | .21 | .23 |

The coloration of No. 21022 is as follows: ground color of venter uniform yellow; ventrals with narrow black tips, and each with a longi-

tudinal black spot on each side, forming an interrupted lateroventral line; outer three scale rows light brown, each scale with a black base; these black markings are emphasized on the lower half of the fourth scale row, and outline an obscure light band on the fourth, fifth, and sixth rows; dorsal area between these rows darker; an obscure light vertebral line on the neck.

Each of these specimens had a number of small fish in its stomach.

***Natrix octolineata* (Boulenger)**

Figure 12

A specimen in the American Museum collection from Tungechuan, Yunnan, was purchased from Rosenberg as *octolineata*. It agrees in coloration with the original description (Boulenger, 1904, p. 133). It has 160 ventrals, 63 caudals, 8 upper labials, 11 lower labials, 2 pre-

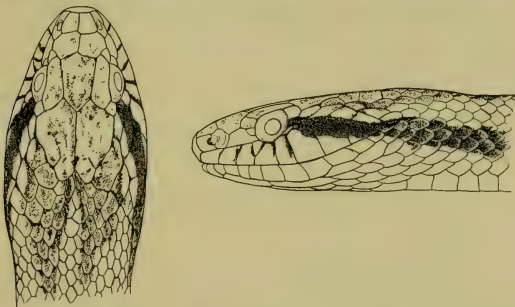


Fig. 12. *Natrix octolineata* (Boulenger).

Dorsal and lateral views of head of A. M. N. H. No. 13595, $\times 1.5$.

oculars, 3 postoculars, and temporals 2-2. It differs somewhat from the type in having two preoculars on each side. On one side it has an irregular subocular cut off from a labial and the loreal united with a third preocular and thus entering the eye.

***Natrix septemlineata*, new species**

Figure 13

TYPE.—A. M. N. H. No. 21051; ♂; Tengyueh, Yunnan; May 17, 1917; R. C. Andrews and Edmund Heller.

DIAGNOSIS.—Dorsal scale rows 19, weakly keeled, the outer row smooth; ventrals 159-171; anal divided; caudals 82-89; upper labials 8; one preocular; three postoculars; temporals 2-1-2; venter uniform light, without spots at the ends of the ventrals; back with seven dark longitudinal stripes.

DESCRIPTIONS OF TYPE.—Body slender, tail about one-fourth of the total; head narrow, elongate; eye rather large.

Rostral barely visible from above, nearly twice as wide as high, its suture with an internasal equal to that with the first labial; internasals as long as wide, shorter than the prefrontals; frontal as long as the parietal suture, slightly longer than its distance from the end of the snout; nasal divided, nostril large, lateral; loreal a little longer than high; one preocular; three postoculars; temporals 2-1-2 and 2-1-3; upper labials 8, the 4th and 5th entering the eye; lower labials 10, five in contact with the anterior chin-shields; second pair of chin-shields slightly longer than the first.

Dorsal scales weakly keeled, in 19-17 rows, the outermost smooth; ventrals 171; anal divided; subcaudals 89.



Fig. 13. *Natrix septemlineata*, new species.

Dorsal and lateral views of head of type, $\times 2$.

Venter uniform light fawn; back longitudinally striped; a narrow black line on the tips of the ventrals and the lower edge of the first row of scales; a light fawn-colored band on the first and second rows; a black band on the second, third, and fourth rows; a light band above this on the fifth and sixth rows; dorsal area between these rows dark gray with the margins of the seventh rows and of the vertebral row black, thus forming three additional double black lines; the lateroventral lines and the vertebral line are absent on the neck, which has four sharply defined black bands, of which the lower originate at the eye and the upper on the parietals; labials entirely immaculate, except where the postocular stripe crosses the seventh and eighth.

The type measures 627 mm., tail 165 mm., .26 of the total length.

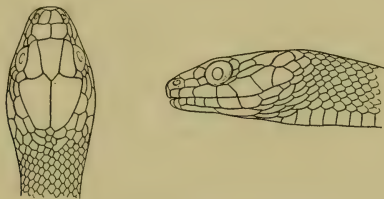
NOTES ON PARATYPES.—The two paratypes, A. M. N. H. Nos. 21050 and 21052, bear the same data as the type. They agree closely in coloration and scale characters, except that one has only 159 ventrals.

This species is closely allied to *Natrix himalayana* in scale characters, but differs radically in coloration, in which it resembles *Natrix pleurotaenia* from Yunnanfu.

Natrix johannis (Boulenger)

Figure 14

A. M. N. H. Nos. 12808, Wutingchow District, and 21076, Yunnanfu, Yunnan, collected by John Graham, represent this species in the American Museum collection.

Fig. 14. *Natrix johannis* (Boulenger).

Dorsal and lateral views of head of A. M. N. H. No. 21076, $\times 2$.

These specimens extend the range of ventrals and present some variations from Boulenger's description (1908, p. 244). They agree exactly in coloration. Their scale characters are as follows:

| A. M. N. H. Nos. | 12808 | 21076 |
|-------------------|----------|----------|
| Sex | ♀ | ♂ |
| Dorsal Scales | 21-19-18 | 20-19-17 |
| Ventrals | 161 | 175 |
| Caudals | 85 | 89 |
| Upper Labials | 8 | 7 |
| Lower Labials | 10 | 9 |
| Preocular | 1-1 | 1-2 |
| Postoculars | 2-3 | 3-3 |
| Temporals | 1-2, 2-2 | 2-1 |
| Total Length | 470 mm. | 380 mm. |
| Tail/Total Length | .26 | .26 |

Pseudoxenodon macrops (Blyth)

Two specimens, A. M. N. H. Nos. 21033 and 21074, Tengyueh, May, 1917, R. C. Andrews and Edmund Heller.

These two specimens might be identified with *P. sinensis* Boulenger, as their scale counts fall just at the upper limit of variation in the latter. Their locality is intermediate between the ranges of the two forms, and additional specimens may unite them as subspecies. The characters of the two Tengyueh specimens are as follows:

| | | |
|------------------|----------|----------|
| A. M. N. H. Nos. | 21033 | 21074 |
| Sex | ♂ | ♀ |
| Dorsal Scales | 17-19-15 | 19-19-15 |
| Ventrals | 154 | 164 |
| Subcaudals | 71 | 67 |
| Upper Labials | 7 | 7 |
| Lower Labials | 8 | 8 |
| Preoculars | 1 | 1 |
| Postoculars | 3 | 2-3 |
| Temporals | 2-2 | 2-3 |
| Length | 700 mm. | 370 mm. |
| Tail/Length | .23 | .20 |

***Pseudoxenodon sinensis* Boulenger**

Twenty-two specimens of this species, A. M. N. H. Nos. 5270, 8915, 12790-12798, 17398-17401, 17703, 18081, 21077-21081, were purchased by The American Museum of Natural History from the Rev. John Graham, all collected near Yunnanfu, Yunnan.

In this series, the dorsal scale count is uniformly 19-17-15, with 19 rows at mid-body; the upper labials are 7, with a single exception, in which they are 8 on one side; the lower labials are 8 or 9; the preocular is invariably single; postoculars invariably 3; anterior temporals invariably 2; second row of temporals 1-3.

Summary of Ventrals, Caudals and Tail/Length

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 8 | 138-146 | 144 |
| | ♀ | 14 | 149-162 | 155 |
| Caudals | ♂ | 7 | 60- 68 | 62 |
| | ♀ | 14 | 57- 66 | 61 |
| Tail/Total Length | ♂ | 7 | .18-.22 | .20 |
| | ♀ | 14 | .19-.20 | .19 |

***Pseudoxenodon dorsalis* (Günther)**

A. M. N. H. No. 21014, Yenping, Fukien, 1916, collected by H. R. Caldwell.

This specimen differs notably from the type of *dorsalis* in both scale characters and coloration, and agrees closely with the series from Formosa described by Steindachner as *Pseudoxenodon macrops* (1914, p. 327, Pls. III-IV, text figs. 5-7). It differs from all of the species described in having an immaculate venter. Its dorsal pattern is more distinct than that of *dorsalis* or of the Formosan specimens, doubtless

accounted for, however, as a juvenile color phase. It differs from *P. stejnegeri* Barbour in having a single preocular and a different coloration. Altogether, the status of the Formosan and Fukien *Pseudoxenodons* is far from clear. Werner (1909, p. 214) describes two specimens from Canton and locality unknown, which have ventrals 131-143, caudals 52-58, and dorsals at mid-body 17-19.

In the present specimen there are 24+5 light dorsal spots, a little wider than long, each of which is bordered by black, and accompanied by a black lateral bar which extends from the border of the spots to the ventrals. The top of the head is immaculate; a broad black nuchal marking begins just behind the parietals, forks, and extends to the ninth ventral. Fourth, fifth, sixth, and seventh upper labials with small black spots at their posterior margins.

A singular anomaly consists in the fusion of the loreal and posterior nasal on each side. The scale characters and measurements of this specimen and of the type of *dorsalis* are as follows:

| | A. M. N. H. | |
|-------------------|-------------|---------|
| Museum Number | 21014 | B. M. |
| Sex | ♀ | ♀ |
| Dorsal Scales | 19-17-15 | 17-15 |
| Ventrals | 153 | 140 |
| Caudals | 56 | 51 |
| Upper Labials | 8 | 8 |
| Lower Labials | 9 | .. |
| Preoculars | 1 | 1 |
| Postoculars | 3 | 2-3 |
| Temporals | 2-2 | 2-2 |
| Total Length | 243 mm. | 610 mm. |
| Tail/Total Length | .18 | .17 |

***Pseudoxenodon bambusicola* Vogt**

A single specimen, purchased at Wuhu, Anhwei, by Clifford H. Pope, 1922, is A. M. N. H. No. 23527.

The type locality of this species is "Mountains of the Hunan and Kiangsi border (of Kwantung), 600 to 900 meters altitude." The present specimen, a male, has dorsal scales 19-17-15; ventrals 131; anal divided; subcaudals 51; upper labials 8, the 4th and 5th entering the eye; lower labials 9; oculars 1-2; temporals 2-2; total length 339 mm., tail 60 mm., tail/length .18.

Zaocys dhumnades (Cantor)

Twenty-five specimens, A. M. N. H. Nos. 23540, 24504-24506, 24510-24523, 24544-24548, 24594-24595, from Ningkwo, Anhwei, collected by Clifford H. Pope, September-October, 1921.

The scaling of the head is equally invariable and almost identical with that of *Z. nigromaculatus*. A number of specimens in this series being skins, the sex consequently indeterminable, and their being no apparent difference in scale characters in the sexes, I have combined the data for the two sexes in the following tabulation.

Summary of Measurements and Scale Characters

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|----------------|-------|---------------------|--------------|---------|
| Ventral Plates | ♂ + ♀ | 25 | 186-197 | 192 |
| Subcaudals | ♂ + ♀ | 9 | 105-118 | 113 |
| Length | ♂ + ♀ | 8 | 452-1258 mm. | ... |
| Tail/Length | ♂ + ♀ | 8 | .26-.30 | .28 |

Zaocys nigromarginatus (Blyth)

Eight specimens agree with Boulenger's diagnosis of this species: A. M. N. H. Nos. 21001, 21002, 21059, 21060, Tengyueh, Yunnan, May, 1917, collected by R. C. Andrews and Edmund Heller; and 23496, 23502, Luanshikau, 3000 feet altitude, Wanhsien, Szechwan, September, 1921; and 23503, 23510, Wanhsien, Szechwan, December, 1921, collected by Walter Granger.

I find no differences between the Yunnan and the Szechwan specimens. The dorsal scales are uniformly 16-14; the upper labials invariably 8; the preoculars and postoculars 2-2; the temporals 2-2; and the lower labials are 10 with an occasional 9.

Summary of Measurements and Scale Characters

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|----------------|-----|---------------------|---------------|----------|
| Ventral Plates | ♂ | 8 | 197-202 | 199 |
| Subcaudals | ♂ | 4 | 123-131 | 127 |
| Length | ♂ | 5 | 1505-1915 mm. | 1710 mm. |
| Tail/Length | ♂ | 4 | .28-.31 | .30 |

***Coluber spinalis* Peters**

Plate XXVIII, Figure 1

Seven specimens in the collection: A. M. N. H. Nos. 21470, 26 miles south of Hsing Lung Shan, Eastern Tombs, Chihli, August, 1921, Clifford H. Pope; 23921-23922, Mai Tai Chao, Shansi, May, 1922, C. H. Pope; 28257, 28266, Chen Tzu, Taiyuan, Shansi, July-August, 1922, Clifford H. Pope; 28261, 28284, So Huang, Ping Ting, Shansi, September 4-15, 1922, Clifford H. Pope.

The dorsal scales are 17-15, except in one specimen which has 17-16-14. The ventrals range from 190 to 195 in four males, 197 to 209 in three females; the caudals from 98 to 103 in males, 88 to 99 in females. Upper labials uniformly 8, lower labials 9 or 10. Preoculars uniformly 2, the postoculars 2 with a single exceptional 1. Temporals 2-3 or 2-2. The range in length is from 280 mm. to 944 mm. The tail/length varies from .25 to .27 of the total in females, .25 to .29 in males.

It is interesting to note that the juvenile specimen shows no signs of crossbars, which are so characteristic of the supposed congeners of this form in North America.

***Ptyas korros* (Schlegel)**

Two specimens, A. M. N. H. Nos. 21046, Fukien Province, 1916, R. C. Andrews and Edmund Heller, and 23521, Yenping, Fukien, 1921, H. R. Caldwell, represent this species. They afford no noteworthy variation from the Hainan series collected by Clifford H. Pope.

***Lycodon fasciatus* (Anderson)**

A. M. N. H. No. 12799, Yunnanfu, Yunnan, February, 1919, John Graham, much extends the range of this form, which has recently been described and figured by Wall (1911, p. 948, Pl. xv, map).

This specimen has 195 ventrals and 70 caudals, compared with a minimum of 200 and 74, respectively, given by Wall. Otherwise it evidently agrees with the Burman specimens of this species. Additional specimens from Yunnan might establish the existence of a subspecific form in this area.

***Dinodon rufozonatum rufozonatum* (Cantor)**

Twenty-six specimens represent this most strikingly colored of Chinese snakes, all collected by Clifford H. Pope. These are distributed as follows: A. M. N. H. Nos. 21473-21474, 26 miles south of Hsing Lung Shan, Eastern Tombs, Chihli, August 12, 1921; 28256, Niantzekwan,

Shansi, September 15-18, 1922; 28267, 28329-28334, Chen Tzu, Taiyuan Shansi, July-August, 1922; 23488, 24529, 24531, 24551-24557, 25573-25575, Ningkwo, Anhwei, October, 1921; 24624, 24654, Wuhu, Anhwei, September-October, 1921.

It is natural to compare the Chihli and Shansi series with the specimens from Anhwei, and some differences are apparent. Thus the loreal enters the eye in 69% of the Anhwei series and only in 35% of the northern specimens. The number of light crossbars is fewer on both body and tail in the northern series, but the extremes overlap: the figures are as follows:

| | | DORSAL LIGHT CAUDAL LIGHT | |
|---------------------------------------|----------|---------------------------|-------|
| | | BARS | BARS |
| Anhwei Series, 14 Specimens | Extremes | 50-70 | 14-26 |
| | Average | 61 | 20 |
| Chihli and Shansi Series, 9 Specimens | Extremes | 46-63 | 12-20 |
| | Average | 56 | 17 |

When these series are analyzed for sex differences, the numbers of specimens are too small to give conclusive results on the degree of geographic variation.

Most of the scale characters of this species are extremely constant. The dorsal scales are uniformly 19-17-15 in the Anhwei specimens, 19-17-15 in five of the northern specimens, 17-15 in five. Undivided subcaudals appear as an anomaly, No. 28256 having eight subcaudals entire.

Summary of Measurements and Scale Characters

| | SEX | NO. OF SPECIMENS | EXTREMES Anhwei Series | AVERAGE |
|--------------------------|-----|------------------|------------------------|---------|
| Ventral Plates | ♂ | 5 | 196-200 | 199 |
| | ♀ | 8 | 196-205 | 201 |
| Subcaudals | ♂ | 3 | 69- 84 | 75 |
| | ♀ | 8 | 65- 73 | 68 |
| Length | ♂ | 3 | 241-971 mm. | .. |
| | ♀ | 8 | 507-991 mm. | 778 mm. |
| Tail/Length | ♂ | 3 | .18-.21 | .19 |
| | ♀ | 8 | .17-.19 | .18 |
| Chihli and Shansi Series | | | | |
| Ventral Plates | ♂ | 6 | 192-200 | 195 |
| | ♀ | 4 | 188-197 | 191 |
| Subcaudals | ♂ | 6 | 66- 74 | 70 |
| | ♀ | 3 | 60- 68 | 61 |
| Length | ♂ | 5 | 770-1023 mm. | 876 mm. |
| | ♀ | 3 | 784- 888 mm. | 824 mm. |
| Tail/Length | ♂ | 5 | .17-.19 | .18 |
| | ♀ | 3 | .17-.18 | .17 |

***Dinodon rufozonatum williamsi*,¹ new subspecies**

Figure 15

TYPE.—A. M. N. H. No. 17453; ♀; Changsha, Hunan, China; July, 1920; J. W. Williams.

DIAGNOSIS.—Distinguished from *Dinodon rufozonatum* by a greater number of ventrals, subcaudals, and transverse dorsal markings.

DESCRIPTION OF TYPE.—Body stout, head short, depressed, tail moderate; eye small, with the pupil shortly elliptic, directed somewhat upwards; a strong ventral angle.

Rostral well visible from above; internasals broader than long, about half as long as the prefrontals; frontal as wide as long, as long as its distance from the rostral and as long as the parietal suture; parietals six-sided, bordered by three temporals, of which the last is the largest; loreal elongate, entering the eye on both sides; a small preocular; two postoculars; temporals 2-2; upper labials eight, 3rd, 4th, and 5th entering the eye on both sides; lower labials eleven, five in contact with the anterior chin-shields.

Dorsal scales entirely smooth anteriorly, weakly keeled on the upper rows on the posterior fourth of the body, in 18-17-15 rows; ventrals 207; subcaudals 81.

Ground color above very dark brown, with eighty-seven light fawn crossbars, each about one scale-length in width, about half as wide as the dark interspaces; the light scales punctate with dark brown; the two colors mixed on the sides, which are without regular markings; upper head-shields are of the ground color with light margins; sides of head light with a dark postocular band to the angle of the mouth and a temporal stripe from the parietals to the neck; venter immaculate, between the lateral angles, light yellow; ends of ventrals, outside the angle, with a large brown spot, sometimes indistinct; tail darker beneath, especially toward its tip.

The total length is 1190 mm., tail 218 mm., .18 of the total.

NOTES ON PARATYPES.—Five paratypes in the Williams collection from Changsha are A. M. N. H. Nos. 17437, 17439, 17440, 17443, and 17450. Four of these have nineteen scale rows at mid-body. The ventrals and caudals in three females are 207, 212, 213, and 86, 77, 78; in two males 211, 211 and 78, 84. Upper labials uniformly eight; lower labials ten except in one specimen which has 11-12; oculars 1-2; temporals 2-2 or 2-3; loreal excluded from the eye on one side in one specimen. The dorsal crossbars range from 59 to 74 on the body and from 21 to 26 on the tail.

The ventral count in this form is decidedly higher than in the series of *rufozonatum* examined by me, and is reached in only one recorded specimen (from Korea) which has 208 ventrals; the subcaudals average more, and the dorsal crossbars are decidedly more numerous. The Anhwei and Shansi and Chihli specimens have a more "contrasty" coloration, the



Fig. 15. *Dinodon rufozonatum williamsi*, new species.

Dorsal view of head of type, natural size.

¹Named for Mr. J. W. Williams of the College of Yale-in-China, Changsha, Hunan.

light crossbars extending farther down on the sides, and have more red in the pattern. The ventral angle is very sharply defined in the Hunan series. It is surprising that the Kiukiang specimens in the British Museum do not correspond with the Changsha form.

***Elaphe schrenckii* Strauch**

Nine specimens, A. M. N. H. Nos. 21484-21492, collected at Hsing Lung Shan, Eastern Tombs, Chihli Province, August, 1921, by Clifford H. Pope.

The dorsal scale count varies from 21-19 to 25-23-21-19 and 23-21-19-17. Eight upper labials are normal, seven occurring once. The lower labials range from nine to eleven. The preoculars are two six times and one twelve times. The postoculars are two fifteen times and one three-times. A single anterior temporal occurs three times, two in the remaining cases. The second row of temporals varies from one to four.

The maximum length reaches 1365 mm., and a specimen of 472 mm. is so strikingly different in coloration that it offered some difficulty in identification. The juvenile pattern of this specimen consists of a dark brownish gray ground color, with about thirty-one light crossbands on the body, two to three scales wide, sharply defined anteriorly by narrow white borders and by the black borders of the intermediate brown spaces. Posteriorly the contrast diminishes and the brown and light brown cross bands become equal, the dark borders remaining distinct. The venter is light, heavily spotted with black. The chin and upper labials cream color. Labials, rostral, and mental with narrow black posterior edges. A black band from the eye to the angle of the mouth, bordered above by a light band which extends obscurely across the supraoculars and frontal to join its fellow. A \wedge shaped nuchal light mark behind this, its apex at the posterior edge of the parietals.

The adult coloration is uniform olive-brown above, with obscure black bars on the sides of the neck and black crossbands arranged in pairs on the posterior third of the back, very faint on the sides. About sixteen black crossbands on the tail, the first ten in pairs. The contrast of adult and juvenile color patterns is in some degree a parallel to that of the African water snakes of the genus *Grayia* (Boulenger, 1909, Proc. Zool. Soc. London, p. 944, Figs. 296-298).

Summary of Measurements and Scale Characters

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|----------------|-----|---------------------|----------|---------|
| Ventral Plates | ♂ | 4 | 206-216 | 212 |
| | ♀ | 4 | 220-222 | 221 |
| Subcaudals | ♂ | 4 | 70- 77 | 74 |
| | ♀ | 4 | 64- 72 | 69 |
| Tail/Length | ♂ | 4 | .16-.18 | .17 |
| | ♀ | 4 | .15-.17 | .16 |

The pattern development from juvenile to adult has been described by both Boulenger and Stejneger.

***Elaphe carinata* Günther**

This highly interesting species is represented by a single specimen, A. M. N. H. No. 21043, Tengyueh, Yunnan, May 10, 1917, R. C. Andrews and Edmund Heller.

The dorsal scales, strongly keeled except the outermost row, are in 23-21-19-17 rows; ventrals 223; anal divided; subcaudals 82; upper labials 8; lower labials 10; preoculars 2; postoculars 2-3; temporals 2-3 and 2-6; total length 1595 mm.; tail/total length .17.

The pattern is distinctive, though complicated. Anteriorly there are black crossbands, somewhat obscured by their scales having light centers, on the first half of the body; posteriorly the scales are brown, each with a black border. There are obscure longitudinal lines of black on the neck.

It seems likely that *Elaphe halli* (Boulenger) is directly related to this species. A. M. N. H. No. 21472, a skin without head, brought to Mr. Pope at Hsing Lung Shan, Chihli, either represents a transported specimen of *carinata* or may be a mutilated *Elaphe halli*, whose type locality is Chifeng, northeast Chihli. A second specimen of *carinata*, No. 22702, from Yunnanfu, Yunnan, agrees closely with the one described.

***Elaphe mandarina* (Cantor)**

Three specimens, A. M. N. H. Nos. 23500, 23504, Yenchingkau, 1500 feet altitude, Wanh sien, Szechwan, October, 1921, Walter Granger, and 24622, bought at Wuhu, Anhwei, by Clifford H. Pope, 1922.

The dorsal scales are in 23-21-19 rows; ventrals vary from 212 to 231; subcaudals from 67 to 70; upper labials 7; lower labials 9 in one specimen, 10 in two; preanal postoculars 1-2 in all three; temporals variable, 1-2 to 2-3; dorsal dark crossbars on body and tail 24+8 to 27+11. The largest specimen, a male, measures 1175 mm., the tail amounting to .18 of the total.

The Szechwan specimens present a well-marked color variation, the lateral spots being united with the dorsal markings to form complete crossbands, each of which encloses a light spot dorsally.

***Elaphe porphyracea porphyracea* (Cantor)**

Three specimens, A. M. N. H. Nos. 21065-21067, Tengyueh, Yunnan, May, 1917, collected by R. C. Andrews and Edmund Heller.

The principal characters of this series may be tabulated as follows:

| A. M. N. H. Nos. | 21065 | 21066 | 21067 |
|---------------------------------|---------|---------|---------|
| Sex | ♀ | ♀ | ♂ |
| Dorsal Scales | 19-17 | 19-18 | 19-17 |
| Ventrals | 190 | 196 | 198 |
| Subcaudals | 48 | 52 | 54 |
| Upper Labials | 7 | 7 | 8 |
| Lower Labials | 9 | 9 | 11 |
| Prenal Postoculars | 1-2 | 1-2 | 1-2 |
| Temporals | 0-2 | 0-2 | 1-2 |
| Length | 815 mm. | 289 mm. | 784 mm. |
| Tail/Length | .14 | .14 | .15 |
| Dorsal Crossbands+Those on Tail | 13+0 | 15+3 | 15+4 |

These specimens differ from the two Hainan specimens at hand in having shorter tails, with fewer subcaudals, and a larger number of dorsal crossbands. The Hainan specimens appear to represent *Elaphe nigrofasciata* (Cantor), type locality Singapore, and typical *porphyracea* are intermediate between *nigrofasciata* and the Yunnan form described below.

***Elaphe porphyracea pulchra*, new subspecies**

Figure 16

TYPE.—A. M. N. H. No. 17705; ♂; 20 miles North of Yunnanfu, Yunnan; July 6, 1920; John Graham.

DIAGNOSIS.—Closely allied to *Elaphe porphyracea porphyracea* in pattern; distinguished by having fewer ventrals, 177-185, and subcaudals, 51-56.

DESCRIPTION OF TYPE.—Habitus undifferentiated; rostral wider than high, just visible from above; internasals three-fourths as long as the prefrontals; frontal slightly longer than its distance from the rostral, as long as the parietal suture, a little longer than wide; loreal small, a little longer than high; one preocular; two postoculars; temporals 1-2; upper labials 8, the 3rd and 4th entering the eye; lower labials 9, the first four in contact with the anterior chin-shields, which are about twice as long as the posterior; dorsal scales in 19-17 rows, nearly smooth; ventrals 177; subcaudals 54.

Venter uniform pale yellow; dorsum grayish fawn, with fourteen dark transverse markings on the body and four on the tail; these markings, which are narrowly margined with yellow, consist of a pair of black lines meeting below at the ends of the

ventrals and enclosing an area of the dorsal ground color one and a half scale-lengths broad; a pair of black longitudinal dorsolateral lines begins between the tenth and eleventh crossbands on the seventh and eighth scale-rows; at first discontinuous, these lines become more sharply defined and broader posteriorly, where they lie on the sixth and seventh scale rows, and continue to the end of the tail; head with a black median stripe from the internasal suture to the first dorsals, and a pair of dorsolateral stripes from the eyes to the first crossband on the nape.

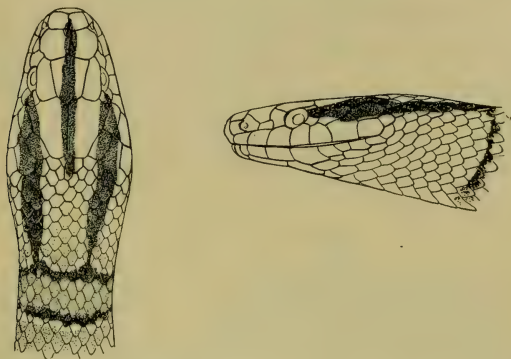


Fig. 16. *Elaphe porphyracea pulchra*, new subspecies.

Dorsal and lateral views of head of type, $\times 1.3$.

Total length 583 mm., tail 103 mm., .18 of the total.

NOTES ON PARATYPES.—The three paratypes are female specimens, all from Yunnanfu, A. M. N. H. Nos. 17396, 22704, 22705. Their ventrals are 181, 185, 185, subcaudals 56, 55, 51. Two have eight upper labials, the other seven. One has nine lower labials, one 9–10, and one 10–10. No other variation in head shields.

In coloration the two adults agree closely with the type, with 12+3 and 13+3 crossbands. No. 17396, measuring 302 mm., has solid black crossbands, the last two exactly alternate, stopping at the vertebral line; the dorsolateral lines begin between the 7th and 8th crossbands; there are small black spots just halfway between the crossbands, on the second scale row.

The tail length in the three specimens is .16 of the total once and .17 twice.

***Elaphe rufodorsata* (Cantor)**

Thirty-five specimens of this species collected by Clifford H. Pope in Anhwei; A. M. N. H. Nos. 23539, 24631–24639, 24641,–24653, Wunu, September–October, 1921; 24501–24503, 24532, 24550, 24559–24561, 24563–24566, Ningkwo, September–October, 1921.

It is remarkable that this entire series fails to show a deviation from the dorsal scale formula 21–19–17. The preoculars and postoculars are

also constantly 1-2. The upper labials are seven, with six exceptions, in which they are eight. The lower labials range from nine to eleven, ten on both sides in thirty specimens. The temporals are normally 2-3, but are occasionally single in the first row, and range from one to four in the second.

The largest male measures 555 mm., the largest female 755 mm.

Summary of Measurements and Scale Characters

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|----------------|-----|---------------------|----------|---------|
| Ventral Plates | ♂ | 14 | 163-172 | 166 |
| | ♀ | 21 | 173-182 | 177 |
| Subcaudals | ♂ | 14 | 56-63 | 60 |
| | ♀ | 20 | 49-53 | 51 |
| Tail/Length | ♂ | 14 | .18-.21 | .20 |
| | ♀ | 20 | .15-.18 | .16 |

Elaphe dione (Pallas)

Plate XXVIII, Figure 2

Sixty-four specimens of *Elaphe dione*, all collected by Clifford H. Pope except as noted, are from the following localities: A. M. N. H. Nos. 21479-21480, 13 miles north of Hsing Lung Shan, Chihli, August, 1921; 21481-21483, Hsing Lung Shan, Chihli, August, 1921; 23923-23934, 24142, 28258, Mai Tai Chao, Shansi, May 6, 1922; 28259-28260, 28285-28295, So Huang, Ping Ting, Shansi, September, 1922; 28263-28266, 28296-28313, Chen Tzu, Taiyuan, Shansi, July-August, 1922; 28269-28277, Tsing Glo, Shansi, August, 1922; 28283, Inner Mongolia, 260 miles s.e., of Sairusu on the Kalgan Trail, R. C. Andrews, 1922.

These specimens agree excellently with Stejneger's account of this species. The single specimen from Inner Mongolia is a very pale one, but it can be matched by many of the Shansi specimens.

Summary of Scale Characters and Measurements (Shansi Series)

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------|-----|---------------------|----------|---------|
| Ventrols | ♂ | 22 | 177-193 | 183 |
| | ♀ | 29 | 188-207 | 197 |
| Subcaudals | ♂ | 21 | 69-78 | 73 |
| | ♀ | 27 | 60-72 | 67 |
| Tail/Length | ♂ | 21 | .20-.24 | .22 |
| | ♀ | 27 | .16-.20 | .18 |

The largest size is reached by a female 1104 mm. in length. The largest male measures 883 mm.

The five specimens from Chihli have a maximum subcaudal count of 79, otherwise falling within the limits of the Shansi series. The Mongolian specimen is close to the average of the Shansi specimens in scale characters.

Three specimens from Ningkwo, at first identified with *Elaphe dione*, appear to require recognition as a distinct form.

***Elaphe bimaculata*, new species**

Figure 17

TYPE.—A. M. N. H. No. 24640; ♀; Ningkwo, Anhwei; September–October, 1921; Clifford H. Pope

DIAGNOSIS.—Closely allied to *Elaphe dione*, from which it is distinguished by color characters. Dorsal scales 25; ventrals 188–207; subcaudals 67–74; transverse dorsal spots dumb-bell-shaped, often separated as a pair of spots; several of these spots unite on the neck and are confluent with the head marking; tail with a light median and dark dorsolateral stripes.

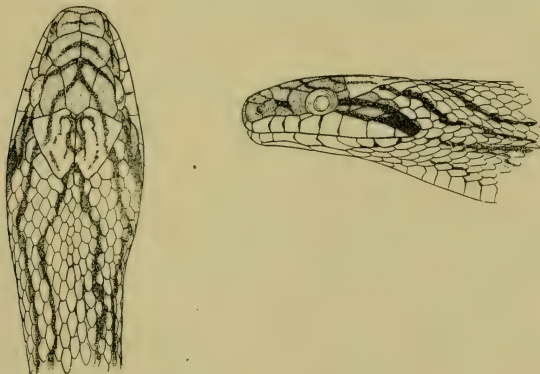


Fig. 17. *Elaphe bimaculata*, new species.

Dorsal and lateral views of head of type, $\times 1.5$.

DESCRIPTION OF TYPE.—Rostral broader than high, visible from above; internasals a little broader than long, their suture more than half the length of the prefrontal suture; prefrontals broadly in contact with the supraoculars; frontal as long as its distance from the snout, shorter than the parietals, much broader in front than behind; nostril between two nasals; loreal small, longer than high; two preoculars, of which the lower is a subpreocular; two postoculars; temporals 2–3; upper labials 8, the fourth and fifth entering the eye; lower labials 9–10; anterior chin-shields longer than the posterior; dorsal scales 25–23–21–19, the first reduction occurring behind the middle of the body; dorsal scales smooth anteriorly, feebly keeled posteriorly; ventral plates 200; subcaudals 74.

Brownish gray above, with transverse darker dumb-bell-shaped markings, sharply outlined with black. These in some places are separated into a pair of spots, and posteriorly they become indistinct; a series of lateral spots alternate with the dorsal series, also outlined with black; a light mid-dorsal line, with less distinct lateral lines, appear on the posterior part of the body, and these become sharply defined on the tail; venter gray with numerous small darker maculations. Head markings sharply defined; a faint black line from eye to eye crossing on the internasals; a pair of black lines from eye to eye on the prefrontals and anterior border of the frontal; a post-ocular black band to the angle of the mouth, enclosing a brown area next the eye; head and neck with a closed, black-margined figure which has its apex on the frontal and extends backward to about the fifteenth ventral, enclosing dark maculations on the parietals; the neck marking evidently consists of two or three confluent dorso-lateral spots; lateral spots on the neck similarly united into a line.

The total length is 770 mm., of which the tail occupies 154 mm., or .20 of the total.

NOTES ON PARATYPES.—A. M. N. H. No. 24549, also from Ningkwo, a juvenile female, has 207 ventrals and 67 subcaudals. No. 24562, from the same locality, is an adult male, with 188 ventrals and 73 subcaudals. Both have a dorsal color pattern identical with that of the type. In No. 24562 the venter is nearly uniform light gray.

It seems barely possible that this is the form referred to as *Elaphe conspicillata* by Werner (1904, p. 357) and by Stanley (1914, p. 28). Although closely allied to *dione*, it seems to be a perfectly distinct form.

Elaphe tæniura tæniura (Cope)

Fifteen specimens of this form all collected in Anhwei, September–October, 1921, by Clifford H. Pope: A. M. N. H. Nos. 24507–25509, 24567, at Ningkwo; 24607–24616, 24625, at Wuhu.

In a former paper I have considered a Hainan specimen of *Elaphe tæniura* as *Elaphe tæniura vaillanti*, which I believe to be a recognizable subspecies in Hainan and S.E. Asia. The type locality of *E. tæniura* is Ningpo, and the present series may be regarded as representative of the typical subspecies. They differ from *vaillanti* and from *gunnanensis* in having a decidedly lower number of ventral plates.

The dorsal scales range from 23–21–19–17 to 25–23–21–19; the lower labials range from 10 to 13, 12 most frequent; the upper labials are usually 8 or 9; one specimen lacks the subpreocular on one side; postoculars invariably 2; temporals 1–2 to 2–5, usually 2–3.

Summary of Scale Characters and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|--|-------|---------------------|----------|---------|
| <i>Elaphe tæniura tæniura</i> (Cope) | | | | |
| Ventral Plates | ♂ + ♀ | 15 | 225-245 | 236 |
| Subcaudals | ♂ + ♀ | 13 | 84-101 | 95 |
| Tail/Length | ♂ + ♀ | 10 | .19-.21 | .20 |
| <i>Elaphe tæniura yunnanensis</i> (Anderson) | | | | |
| Ventral Plates | ♂ + ♀ | 8 | 240-254 | 249 |
| Subcaudals | ♂ + ♀ | 9 | 90-108 | 97 |
| Tail/Length | ♂ + ♀ | 7 | .18-.22 | .20 |
| <i>Elaphe tæniura vaillant</i> (Mocquard) | | | | |
| Ventral Plates | ♂ + ♀ | 2 | 256-259 | 258 |
| Subcaudals | ♂ + ♀ | 2 | 106-120 | 113 |
| Tail/Length | ? | 1 | .24 | .24 |

***Elaphe tæniura yunnanensis* (Anderson)**

Nine specimens: A. M. N. H. Nos. 21003-21005, Tengyueh, Yunnan, May, 1917, R. C. Andrews and Edmund Heller; 21006, Shaowu Fukien, summer, 1916, R. C. Andrews and Edmund Heller; 21007-21009, South China (probably Tengyueh), 1916-1917, R. C. Andrews and Edmund Heller; and 23497, 23511, Wanhshien, Szechwan, December, 1921, Walter Granger.

This form differs from *Elaphe tæniura tæniura* in a number of overlapping characters. The dorsal scales are somewhat fewer both at mid-body and posteriorly, 23 occurring at mid-body in the South Chinese specimens in 66%, 25 in the Anhwei specimens in 73%. The subpreocular is wanting in five out of nine specimens of *yunnanensis*, very rarely absent in *t. tæniura*. The ventrals, subcaudals and proportionate tail length are compared with *tæniura* and *vaillanti* in the tabulation above.

Slight differences distinguish the two Szechwan specimens, which have a slightly higher number of dorsal scales, of subcaudals (103-108) and the subpreocular present in both.

The specimens recorded by Boulenger from the "Western Hills of Peking" offer some difficulty to my subspecific arrangement, as one of the three specimens has 255 ventrals. The specimens recorded by Stejneger from the Amur Province and from Korea, however, have 229 and 231 ventrals, and thus agree with our Anhwei series and help to maintain the lower average.

The two specimens recorded from Darjeeling by Boulenger evidently may be referred to *yunnanensis*.

It seems decidedly preferable to bring the Riu Kiu *Elaphe schmackeri* into the present "Formenkreis." It appeals most directly to *vaillanti*, but is apparently well distinguished by the frequent occurrence of 27 dorsal scale rows.

***Elaphe osborni*,¹ new species**

Figure 18

TYPE.—A. M. N. H. No. 21073; ♀; Tengyueh, Yunnan; May 10, 1917; R. C. Andrews and Edmund Heller.

DIAGNOSIS.—Most closely allied to *Elaphe hodgsoni* (Günther), and *E. taniura* Cope.

Body form not specialized, ventrals not angulate, head distinct from neck; dorsal scales faintly but sharply keeled, in 21 rows; ventrals 215-225; anal divided;

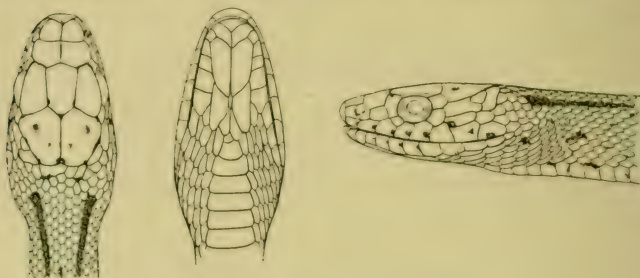


Fig. 18. *Elaphe osborni*, new species.

Dorsal, ventral, and lateral views of head of type, $\times 1.5$.

subcaudals 77-79; supralabials 8, 4th and 5th entering the eye; preoculars 2; postoculars 2; temporals 2-3. Color fawn, with black transverse bars anteriorly and longitudinal lines posteriorly; no black line through the eye.

DESCRIPTION OF TYPE.—Habitus little specialized, ventrals not angulate, head distinct from neck. Maxillary teeth 15, subequal.

Rostral well visible from above, wider than high; internasals a little shorter than the prefrontals; frontal as long as its distance from the tip of the snout, as long as the parietal suture, parallel sided; nasal elongate, the nostril moderate; loreal about as high as long; two preoculars, of which the lower is a small subpreocular; two postoculars; temporals 2-3; upper labials 8, the fourth and fifth entering the eye; lower labials 10, five in contact with the anterior chin-shields, which are longer than the posterior; mental triangular, wider than long.

Dorsal scales with apical pits, faintly but sharply keeled, at least two lateral rows smooth, in 21-23-21-19 rows; ventrals 225; anal divided; subcaudals 79.

¹Named for Professor Henry Fairfield Osborn, President of The American Museum of Natural History, whose personal interest in the Museum's Asiatic Expeditions has greatly furthered their work.

General color fawn-brown; a dorsolateral black line on each side of the neck, reaching and passing the first black dorsal crossbar, and indicated on subsequent crossbars; a longitudinal row of narrow black spots below this; middle third of the body with somewhat irregular narrow dorsal black crossbars from ventral to ventral, mostly elongate between the 4th and 5th row to indicate a lateral line, which becomes, continuous on the posterior third of the body, between the 3rd and 4th scale rows; a row of dorsolateral spots on the 7th and 8th scale rows in this part of the body also tend to form a line, and continue as very distinct lines on the tail, which is otherwise uniform; most of the anterior and middle ventrals with black dots near their outer ends, and the ventrals opposite the black dorsal bars with large black marks on their tips; venter posteriorly uniform; a few small black spots on parietals and labials.

This specimen measures 404 mm., of which the tail occupies .18.

A second specimen, A. M. N. H. No. 21072, from the same locality, agrees very closely with the above in coloration and essential scale characters; its dorsal scale formula is 21-19-17; ventrals 215; subcaudals 77.

This species is apparently identical with *Elaphe walli* (Werner), which is compared with the same species, *E. hodgsoni*, and differs from the above description chiefly in coloration. The differences may well be explained as age characters, Werner's specimen being much larger than ours. Though dated 1924, Werner's paper (1924a) was not received until some two months after the date of publication of my diagnosis¹ of *Elaphe osborni*, February 13, 1925. The question of priority thus raised must evidently be referred to a European authority for the exact date of Werner's paper.

***Gonyosoma caldwelli*,² new species**

Figure 19

TYPE.—A. M. N. H. No. 21010; ♂; Yenping, Fukien; 1916; H. R. Caldwell.

DIAGNOSIS.—Very closely allied to *Gonyosoma melli* (Vogt), from Kwangtung, and to *Gonyosoma frenata* Günther, of the Khasi Hills.

Head and body elongate, body compressed; ventrals sharply angulate; snout obliquely truncate, projecting; dorsal scales very faintly keeled, in 19 rows; ventrals 223; anal divided; subcaudals 108 (?+); supralabials 8, third, fourth, and fifth entering the eye; no loreal; one preocular; two postoculars; temporals 1-2; uniform green above and below, with a black stripe through the eye.

DESCRIPTION OF TYPE.—Habitus of a tree snake, body and tail elongate, body compressed, ventrals strongly angulate; head slightly elongate, distinct from the neck, convex above in lateral profile; snout obliquely truncate, strongly projecting. Pupil round. Maxillary teeth 21 or 22, the last slightly enlarged.

Rostral just visible from above, broader than high; internasals broader than long, their suture half that of the prefrontals; frontal a little shorter than its distance from the rostral, as long as the parietal suture, five-sided, the lateral borders slightly concave; supraoculars as broad as the frontal; parietals truncate behind, drawn down

¹American Museum Novitates, No. 157, p. 4.

²Named for Mr. Harry R. Caldwell, who is largely responsible for the Expedition's Fukien collections.

at their latero-anterior corners to meet the lower postoculars; nasal elongate rhomb, longer than its distance from the eye; nostril large, in the middle of the nasal, with a groove extending to the upper border of the nasal; loreal absent; prefrontals in contact with the second labial; preocular large, not in contact with the frontal; upper labials 8, third, fourth, and fifth entering the eye; lower labials 10-11, five or six in contact with the anterior chin-shields, which are longer than the posterior; oculars 1-2; temporals 1-2; mental wider than long.

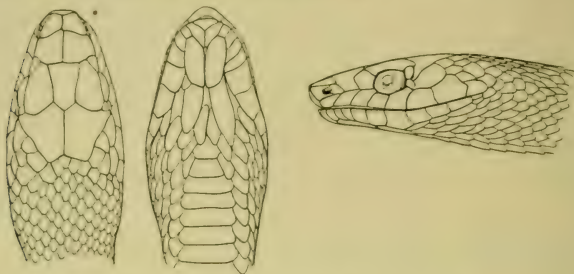


Fig. 19. *Gonyosoma caldwelli*, new species.
Dorsal, ventral, and lateral views of type, natural size.

Dorsal scales with rather faint apical pits, all except the outer row with very low and faint keels; scale rows 19-17-15; ventrals 223; anal divided; subcaudals 108.

Uniform bluish green above and below, doubtless green in life; a black post-ocular streak, apparently obscured by the preservation.

Length 1231 mm., tail length .26 of the total.

This species approaches *Rhadinophis melli* Vogt (Vogt, 1922, p. 140), from Kwangtung, rather closely. The latter has 212-216 ventrals, 144-148 subcaudals, and two anterior temporals, and thus appears to be amply distinct from *G. caldwelli*. The supposed generic characters of the dentition of *Rhadinophis* may easily be explained by the loss of alternate teeth, a very common phenomenon in the preparation of snake maxillae for examination.

The *Coluber frenatus* from Col des Nuages, Ngoi-Tio, 4500-6500 feet altitude, Tonkin, Indo-China, recorded by Parker (1925, p. 305) is stated to have 205 ventrals and 145 subcaudals. It thus approaches *Gonyosoma melli* very closely.

***Liopeltis major* (Günther)**

Four specimens, A. M. N. H. Nos. 21011, Yenping, Fukien, 1916, R. C. Andrews and Edmund Heller; 21034, 21035, Futsing, Fukien, July, 1916, R. C. Andrews and Edmund Heller; and 23531, bought at Wuhu, by Clifford H. Pope, 1921.

These specimens agree excellently with the Formosan series described by Stejneger. The minimum ventral count is reached in No. 21035 with 156. The uniform presence of only six lower labials is highly characteristic. Good series of this species from Fukien are much to be desired for comparison with the Formosan representatives.

The dorsal scale rows are uniformly fifteen throughout in three specimens, reducing to thirteen near the anus in one. Ventrals range from 156 to 168; subcaudals from 82 to 88; temporals 1-1 or 1-2. The largest specimen measures 836 mm. In the two male specimens the tail length is .27-.28 of the total, .24-.26 in the two females.

Holarchus chinensis (Günther)

Two specimens, A. M. N. H. Nos. 25571 Ningkwo, Anhwei, September-October, 1921, Clifford H. Pope, and 22706, Yunnanfu, Yunnan, John Graham, represent this species.

The Yunnan specimen agrees closely with the type in scale characters. The specimens recorded by Boulenger as coming from Hainan (cf. Schmidt, 1927, p. 398) agree closely with the Ningkwo specimen. It seems possible that there are two forms at present confused under this name. The Yunnan specimen differs from the Anhwei specimen in having narrower black crossbands intermediate between the principal series, and a light vertebral line. The scale characters and measurements are as follows:

| A. M. N. H. No. | 25571 | 22706 |
|-------------------|---------|----------|
| Sex | ♂ | ♀ |
| Dorsal Scales | 17-15 | 17-15 |
| Ventrals | 170 | 192 |
| Caudals | 61 | 51 |
| Upper Labials | 7 | 9 |
| Lower Labials | 9 | .. |
| Preoculars | 1 | 1 |
| Postoculars | 2 | 2 |
| Temporals | 1-2 | 1-2, 2-2 |
| Dorsal Crossbands | 12+4 | 13+3 |
| Total Length | 261 mm. | 496 mm. |
| Tail/Total Length | .19 | .15 |

Holarchus violaceus (Cantor)

Three specimens, A. M. N. H. Nos. 18618, Fukien Province, H. R. Caldwell, March 18, 1921; 21015, Yenping, Fukien, R. C. Andrews and Edmund Heller, summer, 1916; and 23536, bought at Wuhu, Anhwei, by Clifford H. Pope, 1921.

These specimens fall within the range of the Hainan series examined by me. There is no noteworthy difference in scaling or coloration.

***Ahaetulla boiga* (Lacépède)**

A. M. N. H. No. 21045, Lung Ling Ling, Yunnan, R. C. Andrews and Edmund Heller, March, 1917, represents this form.

The dorsal scales are 15-13-11; ventrals 192; tail incomplete; upper labials 9-10; lower labials 10; oculars 1-2; temporals 1-2-3 and 2-2-2.

***Calamaria septentrionalis* Boulenger**

Eight specimens, A. M. N. H. Nos. 23535, 24533-24535, collected at Wuhu, Anhwei, and Nos. 24618-24620, 25572 at Ningkwo, Anhwei, September-October, 1921, by Clifford H. Pope.

This series shows the most complete uniformity. The dorsal scales are in 13 rows from head to tail; ventrals range from 160 to 161 in two males, from 170 to 184 in six females; subcaudals in the male specimens 18, in the females 9-11; upper labials 4; lower labials 5; oculars 1-1; temporals none; tail length .03 of the total in females, .07 in male specimens. The maximum length is 373 mm.

"A small 'two-headed snake' was discovered by a Chinaman while cutting grass on the side of a mound of earth beside an old garden path. When taken in the hand it went through violent spasmodic contortions for about five minutes, whereupon, apparently exhausted, it relaxed and turned over on its back.

"Another specimen, when put on the floor, was able to progress in regular snake-fashion. When held by the tail it continued to try to escape. When its head was held to the floor, the whole body was instantly thrown forward, wrapped around the restraining fingers, and the tip of the tail was repeatedly pressed against them. It seems that the tail takes the offensive while the head invariably tries to escape! The tail, in short, not only mimics the head in form and color pattern, but in behavior as well." (C. H. P.)

***Enhydryis plumbea* (Boie)**

This species is represented by A. M. N. H. Nos. 21013, Yenping, Fukien, R. C. Andrews and Edmund Heller, 1916, and 23537, bought at Wuhu, Anhwei, by Clifford H. Pope, 1921.

These specimens present no anomaly. The Fukien mountain range apparently represents the western limit of the range of this form in this part of China.

Enhydris chinensis (Gray)

Two specimens, A. M. N. H. Nos. 21075, without data, and 23494, Fukien Province, collected by H. R. Caldwell, 1921.

These specimens agree with the Hainan series. This species reaches the Yangtze Valley.

Boiga sinensis, new species

Figure 20

TYPE.—A. M. N. H. No. 23495; ♂; Fukien Province; 1921; H. R. Caldwell.

DIAGNOSIS.—Closely allied to *Boiga krapelini* Stejneger, from Formosa.

Head short and broad, the snout longer than the diameter of the eye; body compressed, tail long; ventrals not angulate; anterior palatine teeth slightly enlarged; posterior pair of chin-shields much smaller than the anterior; dorsal scales smooth, oblique, in 21 rows, the mid-dorsal row not enlarged; ventrals 230; anal divided;

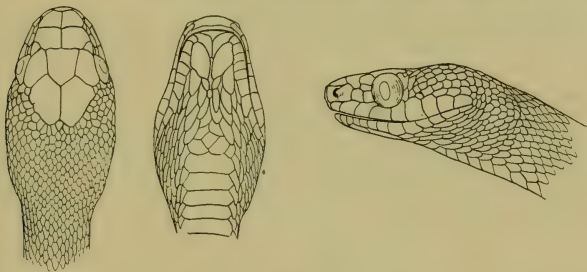


Fig. 20. *Boiga sinensis*, new species.

Dorsal, ventral, and lateral views of head of type, natural size.

caudals 127; preoculars 3; postoculars 2-3; temporals very small, 4 to 6 in the first row, 6 to 7 in the second, not regularly arranged; ground color light reddish brown, with three series of darker brown spots.

DESCRIPTION OF TYPE.—Body strongly compressed, head short and broad, very distinct from the neck; eye large, with vertically elliptic pupil; tail long and slender. Anterior palatine teeth slightly enlarged; maxillary teeth 12, subequal, with two enlarged, grooved fangs.

Rostral visible from above, narrowed above, wider than high; internasals wider than long, their suture two-thirds that of the prefrontals; prefrontals laterally on the side of the head to the loreal; frontal five-sided, as long as its anterior breadth, its sides nearly parallel, wider than the supraocular, shorter than its distance from the rostral, as long as the parietal suture; nasals large, divided, nostril large, anterior nasal on the front of the snout; loreal small, slightly higher than long; preoculars three, the upper not in contact with the frontal; postoculars 2-3; temporals replaced by very small undifferentiated scales, four to six in the first row; upper labials 9-10,

the third, fourth and fifth entering the eye; lower labials 13, four in contact with the anterior chin-shields; anterior chin-shields a little longer than and twice as wide as the posterior pair, which are widely separated; mental broader than long.

The dorsal scale rows range from twenty-five on the neck to twenty-one at mid-body and fifteen near the tail; the dorsal scales are smooth, pointed, in oblique rows, the dorsal series not at all enlarged; I am unable to discover apical pits: ventrals 230; anal divided; subcaudals 127. The top of the head is light reddish brown, uniform, and the ground color of the back is similar; a series of darker brown dorsal spots, 5-7 scales wide and 2-3 scales long, and an alternate series of smaller spots on each side, their scales black edged; posteriorly the lateral spots become indistinct; venter brown, with faint darker and lighter clouding; tail punctate beneath with dark brown.

The total length is 1201 mm., of which the tail occupies .25.

This species is very closely allied to *Boiga kræpelini* of Formosa, which has a much higher range of ventral and subcaudal counts, 236-250, and 140-154 (Steindachner, 1914, p. 343).

Both species have an ally in *Boiga forsteni* of India and Ceylon.

***Bungarus multicinctus* Blyth**

This species is represented by A. M. N. H. Nos. 21027, Shaowu, Fukien, R. C. Andrews and Edmund Heller, 1916, and 23512, Yochow, Hunan, Clifford H. Pope, 1922.

These specimens present no noteworthy variation.

***Naja naja atra* (Cantor)**

The common cobra of South China is represented by A. M. N. H. Nos. 21012, Yenping, and 21044, Futsing, Fukien Province, R. C. Andrews and Edmund Heller, 1916.

These specimens agree excellently with the series collected in Hainan by Clifford H. Pope.

***Amblycephalus chinensis* Barbour**

Two specimens, A. M. N. H. Nos. 23505, collected at Luanshikau, 3000 feet altitude, Wanhshien, Szechwan, September, 1921, by Walter Granger, and 22703, Yunnanfu, Yunnan, John Graham, represent this rare form. These agree with Barbour's description and figure (1912, p. 132, Pl. II, fig. 1). Their scale characters and measurements are as follows:

| A. M. N. H. Nos. | 23503 | 22703 | M. C. Z. 7326 |
|-------------------|----------|---------|---------------|
| Sex | ♀ | ♀ | ♀ |
| Dorsal Scales | 15 | 15 | 15 |
| Ventrals | 177 | 169 | 180 |
| Subcaudals | 63 | 64 | 60 |
| Upper Labials | 7-8 | 7 | 7 |
| Lower Labials | 9-10 | 8-7 | 8-8 |
| Preoculars | 2 | 2 | 2 |
| Postoculars | | 2 | 2-1 |
| Temporals | 2-2, 2-3 | 2-3 | 2-3 |
| Total Length | 496 mm. | 502 mm. | .. |
| Tail/Total Length | .19 | .22 | .. |

Crotalidæ

Agkistrodon strauchi Bedriaga

A single specimen, A. M. N. H. No. 21020, Snow Mountain, 9000 feet altitude, Likiang, Yunnan, R. C. Andrews and Edmund Heller, November, 1916, represents this species.

The dorsal scales are 21-19-17-15; ventrals 140; anal single; subcaudals 32; upper labials 6; lower labials 9; oculars 1-2; temporals 2-3 and 2-4; length 470 mm., tail 60 mm., .13 of the total. The color is brown with obscure black markings; a pair of black spots on the fronto-parietal area.

The specimen contained 6+3 eggs, measuring about 12×15 mm., without embryos.

This specimen was identified as *A. tibetanus* Barbour, which must be united with *Agkistrodon strauchi* Bedriaga.

Agkistrodon halys brevicaudus (Stejneger)

Forty-eight specimens are referred to this form: A. M. N. H. Nos. 21475, 21496-21506, Hsing Lung Shan, Chihli, August, 1921, C. H. Pope; 24524-24526, 24536-24543, 24558, 25550-25570, Ningkwo, Anhwei, September-October, 1921, C. H. Pope; 23489, Shez, Wanhsien, Szechwan, 1921, Walter Granger; 23513, Yochow, Hunan, March, 1922, C. H. Pope; 28278, Chen Tzu, Taiyuan, Shansi, July-August, 1922, C. H. Pope.

The Ningkwo series contains two color phases, reddish brown and dark gray respectively, of which only the gray phase is matched in the Chihli series. The identity in scale characters of these three series is shown in the following tabulation.

The normal dorsal scale count is 23-21-19-17; 21-19-17 occurs twice in the Chihli series, twice in the Anhwei series, and in the Hunan

Variation in *Agkistrodon halys brevicaudus* and *internedius*

| | Sex | Ventrals | | | Caudals | | | Tail/Total Length mm | | |
|--|-----|--------------|----------|------|--------------|----------|------|-------------------------|----------|------|
| | | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean |
| <i>Agkistrodon h. brevicaudus</i> (Chihli Series) | ♂ | 3 | 138-142 | 140 | 3 | 39-44 | 41 | 3 | .12-.15 | .13 |
| | ♀ | 9 | 142-147 | 144 | 9 | 28-39 | 36 | 9 | .10-.13 | .12 |
| | ♂ | 10 | 135-143 | 140 | 10 | 37-43 | 40 | 10 | .12-.14 | .13 |
| | ♀ | 7 | 138-147 | 141 | 7 | 31-37 | 35 | 7 | .11-.13 | .12 |
| | ♂ | 9 | 139-144 | 141 | 9 | 34-44 | 40 | 9 | .11-.14 | .13 |
| | ♀ | 3 | 139-147 | 144 | 3 | 34-38 | 36 | 3 | .11-.13 | .12 |
| <i>Agkistrodon h. internedius</i> Chili Series Shansi Series | ♂ | 3 | 160-168 | 164 | 3 | 40-45 | 42 | 3 | .12-.14 | .13 |
| | ♂ | 3 | 165-175 | 170 | 3 | 48-51 | 49 | 3 | .13-.15 | .14 |
| | ♀ | 3 | 173-181 | 176 | 3 | 43-47 | 44 | 3 | .10-.14 | .12 |

and Szechwan specimens; 25-17 occurs once in the Chihli series, and 27-17 in the single Shansi specimen.

There are no noteworthy differences in head scaling or measurements.

The Shansi specimen, No. 28278, is of especial interest, as it is the only one whose ventral and caudal counts ally it to *intermedius*. It has 153 ventrals and 47 subcaudals. Its coloration agrees more closely with that of *intermedius* than with that of normal *brevicaudus*.

Agkistrodon halys intermedius Strauch

Six specimens, A. M. N. H. Nos. 23920, Mai Tai, Chao, Shansi, May, 1922, collected by Clifford H. Pope; and 28279, Tsagan Nor, Gobi Desert; 28280, 28281, 28347, Tze Tzen Wang, Mongolia, 28282, 260 miles s.e. of Sairusu on the Kalgan Trail, collected in the summer of 1922 by R. C. Andrews.

Three specimens, A. M. N. H. Nos. 21493-21495, collected by C. H. Pope, August, 1921, 13 miles north of Hsing Lung Shan, Chihli, plainly belong with *A. intermedius* rather than with *A. blomhoffii brevicaudus*, though they differ somewhat in scale formula from the Mongolian specimens.

The dorsal scale rows range from 23 to 28 anteriorly, from 21 to 25 at mid-body, and are uniformly 17 near the tail. The upper labials range from six to nine, the lower from nine to twelve. Preoculars and postoculars are uniformly two. Temporals 2-3 to 3-5. The length ranges from 422 to 568 mm., the tail length from .10 to .14 in the three female specimens, and from .13 to .15 in the three males. The ventrals in the male specimens range from 165 to 175, and from 173 to 181 in the females; the subcaudals in males are 48 to 51, in females 43 to 47.

The three Hsing Lung Shan specimens are juvenile males; their coloration agrees closely with that of the Mongolian series; the dorsal scale count and head scales are similar; but the ventrals, ranging from 160 to 168, and the subcaudals, 40 to 45, are distinctly fewer. Nevertheless, the range of ventrals in twelve *brevicaudus*, both male and female, from Hsing Lung Shan, is 138 to 147, so that these specimens are certainly much closer to *intermedius*.

Agkistrodon acutus (Günther)

A single male specimen, A. M. N. H. No. 24665, collected at Shengchorefu, Hunan, by H. H. Johnson.

This specimen agrees closely with Boulenger's description (1896, p. 524). It has 166 ventrals and 55 caudals, of which the first 13 are entire. It measures 1058 mm., of which the tail occupies .14.

Trimeresurus orientalis, new species

TYPE.—A. M. N. H. No. 21028; ♀; Shaowu, Min River, Fukien; 1916; R. C. Andrews and Edmund Heller.

DIAGNOSIS.—Distinguished from its very near relative, the Himalayan *T. monticola*, by having ten upper labials instead of eight or nine; its second near ally, *T. okinavensis*, has seven or eight upper labials.

DESCRIPTION OF TYPE.—Habitus stout; head short and broad, eye very small; body apparently somewhat compressed, with a slight vertebral ridge.

Upper head-shields flat, smooth, frequently broader than long, eight between the supraoculars; temporals smooth; a well-developed pair of internasals, separated by a single small scute; rostral wider than high; upper labials ten on each side, the second forming the anterior border of the loreal pit, the fourth largest; three rows of scales between the eye and the upper labials; lower labials eleven, only two in contact with the anterior chin-shields; second pair of chin-shields scarcely distinguishable; two preoculars, two suboculars, and two postoculars.

Dorsal scales 27–25–21, the uppermost rows very faintly keeled, the rest perfectly smooth; ventrals 138; anal entire; subcaudals 37.

Ground color a light brown, consisting of a brown punctation on a still lighter yellowish brown; a series of subquadrate very dark brown markings on each side of the vertebral line, nearly always alternate and overlapping, and reaching the eighth scale row; a lateral row of small spots of the same color, often connected with the upper row; a lateroventral row of similar spots, often nearly confluent, on the lower scale rows and ends of the ventrals; ventrals light brown, punctate with darker brown, and each with two dark brown markings, which form irregular longitudinal bands; head black anteriorly and on the sides; the posterior part of the top of the head light brownish yellow, with obscure darker markings; posterior upper labials and several of the lower labials with light markings; some of the lateral gulars dark with light central spots on each scale; tail nearly black above with sharply defined small yellow spots, almost forming a longitudinal line.

Length 600 mm., tail 82 mm., .14 of the total.

RANGE.—Fukien and Formosa.

This is the form recorded from Formosa as *T. monticola*. Both Barbour (1909, p. 74) and Steindachner (1914, p. 37) record ten upper labials in their Formosan specimens. It has been recorded from Fukien (also as *monticola*) by Stanley (1914, p. 31). The head pattern of *monticola* figured by Günther (1864, Pl. xxiv, fig. B) is quite different from that of the present specimen; and Steindachner's description (*loc. cit.*), indicates agreement between our Fukien and his Formosan specimens in this respect.¹

Trimeresurus mucrosquamatus (Cantor)

A. M. N. H. Nos. 23508, Yenchingkau, 1500 feet altitude, Wanhsien, Szechwan, Walter Granger, October, 1921, and 23523, Yenping, Fukien, H. R. Caldwell, 1921, represent this species.

¹Werner (1926), regards *orientalis* as a synonym of *monticola*. Where his material is more ample than mine I am disposed to follow his judgement. He has failed, however, to understand the relations of *gramineus* and its Chinese allies, which are discussed below.

The characters of these specimens are as follows:

| A. M. N. H. Nos. | * 23508 | 23523 |
|----------------------------|----------|----------|
| Sex | ♀ | ♂ |
| Dorsal Scales | 27-23-19 | 29-25-19 |
| Ventrals | 206 | 203 |
| Subcaudals | 86 | 93 |
| Upper Labials | 9 | 10 |
| Lower Labials | 14 | 13-14 |
| Oculars | 3-1-2 | 3-1-2 |
| Scales Between Internasals | 3 | 3 |
| Length | 1000 mm. | 864 mm. |
| Tail/Length | .19 | .19 |

***Trimeresurus gramineus* (Shaw)**

Figure 21

A single specimen of this species, as I propose to restrict it, was purchased at Wuhu, Anhwei, by C. H. Pope, 1921 (A. M. N. H. No. 23529). This specimen is therefor of uncertain origin, and it does not

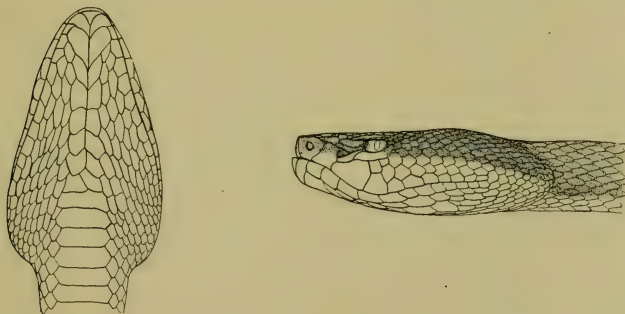


Fig. 21. *Trimeresurus gramineus* (Shaw).

Ventral and lateral views of head of A. M. N. H. No. 27935, Nodda, Hainan. To show paired gulars behind chin-shields, fusion of nasal and first labial, and coloration.

enter into the discussion of the partition of *gramineus* auct. It is remarkable as the only specimen of this group which is brown instead of green. It agrees in scale characters with the Hainan series. A typical Hainan specimen is figured for comparison with the following species.

Trimeresurus stejnegeri,¹ new species

Figure 22

TYPE.—A. M. N. H. No. 21054; ♂; Shaowu, Fukien; summer, 1916; R. C. Andrews and Edmund Heller.

DIAGNOSIS.—Differs from the widespread *Trimeresurus gramineus*, with which it has hitherto been confounded, in the very small shields between the chin-shields and the first ventral plate, the smaller and more widely separated supranasals, the distinct first labial (which in South Chinese *gramineus* is frequently fused with the nasal), and the usual uniform green coloration of the side of the head.

DESCRIPTION OF TYPE.—Habitus of *T. gramineus*.

Upper head shields smooth and flat; no especially enlarged internasals; seven scales bordering the nasals and rostral above; twelve scales between the supraoculars; rostral about as high as wide; upper labials 10–11, the first distinct from the nasal,

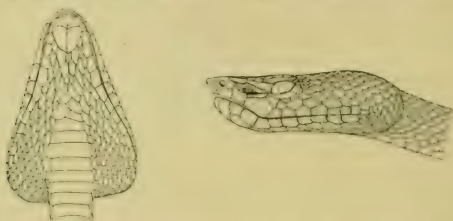


Fig. 22. *Trimeresurus stejnegeri*, new species.²

Ventral and lateral views of head of type, natural size.

the second bordering the loreal pit in front, and the third largest and in contact with the subocular; lower labials twelve, three in contact with the anterior chin-shields; only a single pair of chin-shields is regularly developed and these are followed by irregular gulars which extend to the first ventral; two preoculars, a strap-shaped subocular, and two or three postoculars; one supraocular is transversely divided.

General color dark bluish green (in alcohol), the venter lighter, each ventral with a narrow white posterior border; a narrow white lateroventral line extends along the middle of the first scale row, which is otherwise green; tip of tail brownish; no light markings on the side of the head.

Total length 688 mm., tail 111 mm., .16 of the total.

NOTES ON PARATYPES.—Two additional specimens are associated with this species, A. M. N. H. Nos. 21053, Futsing, Fukien, and 23534 bought at Wuhu, Anhwei. The latter specimen, a female with 155 ventrals and 56 subcaudals, has a pair of slightly developed internasals, separated by a single scale; it has irregular gulars and a uniform green head like the type; the lateral stripe is broad, involving the edge of the second scale row. In the Futsing specimen the lateral stripe is confined to the scales of the first row, the upper halves of which are white and the lower gray. This specimen,

¹Named for Dr. Leonhard Stejneger, Head Curator of Biology, United States National Museum, as a small tribute to his invaluable contributions to Oriental herpetology.

²The pupil is vertical, not round as indicated in the figure.

also a female, has a well-developed pair of internasals, separated by a median scute; somewhat more regular gulars; and but for the uniform green side of the head it would offer some difficulty to distinguish it from *T. gramineus*. It has 164 ventrals and 63 subcaudals. In both paratypes the dorsal scales formula is 25-21-15.

RANGE.—Mountains of Chekiang, Fukien, northern Kwangtung, and Formosa.

In establishing this form I have been guided by the fact that all of the Hainan specimens examined by me (Schmidt, 1925, p. 4), as well as all the available specimens from Indo-China, Siam, and India, have a strikingly distinct series of paired gulars extending from the chin-shields to the first ventral; the supranasals well-developed and usually in contact; and nearly always a light subocular line, below which the side of the head may be white or yellow. The type locality of *T. gramineus* is Vizigapatam, India, and the Indian specimens available for examination (A. M. N. H. No. 5166, "India," 2861, Punjab, and M. C. Z. No. 4490, "India," 4369, Amballa, and 5702, E. India), agree with the Hainan series. I therefore feel justified in restricting *gramineus* to this form, for which *T. albolabris* Gray is obviously a strict synonym.

The Formosan specimen described and figured by Stejneger (1907, p. 480, Figs. 370-372) agrees exactly with my diagnosis of *T. stejnegeri*. Two specimens in the Museum of Comparative Zoölogy (M. C. Z. No. 7389) from Bankoro, Central Formosa, also agree with the northern form. A specimen from Horisha, Formosa (A. M. N. H. No. 5076), combines the widely separated supranasals with somewhat more regular gulars, and has a distinct stripe on the side of the head. The series of nine Formosan specimens examined by Steindachner (1914, p. 39) are described as having small internasals, separated by one to three scales, and the side of the head usually unmarked. It is evident that intergradation between *gramineus* and *stejnegeri* may occur. Mell (1922, p. 126), who first suggested the division of Chinese *gramineus* into a northern and southern form, considers them as subspecies. He differentiated them on the basis of field observation in Kwangtung. Future collections from Fukien may be expected to define the status of *stejnegeri* and its relations with *gramineus* in a satisfactory way.

Two specimens from Moh Kan Shan, Chekiang (U. S. N. M. Nos. 64022, 64023), agree with the Fukien and Formosan specimens on both the supranasal and gular characters.

***Trimeresurus yunnanensis*, new species**

TYPE.—A. M. N. H. No. 21058; ♂; Tengyueh, Yunnan; April-May, 1917; R. C. Andrews and Edmund Heller.

DIAGNOSIS.—Closely allied to *Trimeresurus stejnegeri* and distinguished from *T. gramineus* by the same characters. It is distinguished from the former species by

having only nineteen rows of dorsal scales at mid-body, and twenty-one on the neck, compared with twenty-one at mid-body and 23-25 on the neck in *T. stejnegeri*. The average number of ventral plates, 155-160, is perhaps somewhat lower in *T. yunnanensis*.

DESCRIPTION OF TYPE.—Habitus of *T. gramineus*,

Head-shields on top of head smooth and flat; no enlarged internasals; seven scales border the nasals and rostral above; rostral about as high as wide; upper labials 9-10, the first distinct from the nasal, the second forming the anterior border of the loreal pit, the third largest, and in contact with the subocular; eight scales between the supraoculars; three preoculars, a strap-shaped subocular, and two postoculars; lower labials 11-12, three in contact with the first pair of chin-shields; gulars not paired, irregular.

Dorsal scale-rows twenty-one on the neck, nineteen at mid-body, and fifteen near the tail; ventrals 156; subcaudals 67; dorsal scales all with low keels.

General color bluish green, in alcohol, the venter lighter, each ventral narrowly light-edged behind; a lateral strip on the first scale row, the upper half white, the lower half reddish brown; no markings on the side of the head.

Length 707 mm., tail 145 mm., .21 of the total.

NOTES ON PARATYPES.—The three paratypes, A. M. N. H. Nos. 21055-21057, all from Tengyueh, agree with the type in the low number of dorsal scales, which drop to thirteen near the tail in one specimen, in the coloration of the side of the head, and in the gular character. They have more distinctly developed internasals, in each case separated by a median scute. One has a lateral line like that of the type, one has a narrow white line occupying only the middle of the first scale row, and the third has scarcely any distinguishable lateral line. The ventrals range from 155 to 160, and the subcaudals are 55 in the only one with a complete tail. I have examined two specimens at the Museum of Comparative Zoölogy, M. C. Z. No. 14671, from Yunnan Fu and No. 16734 from Luchien-hsien, Yunnan, which agree excellently with my diagnosis and can accordingly be named paratypes.

This form evidently requires comparison only with *T. stejnegeri*, with which it may prove to intergrade when the intermediate territory is explored.

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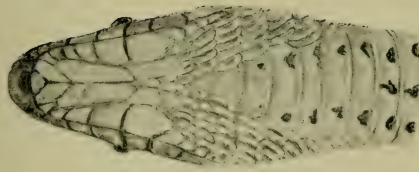
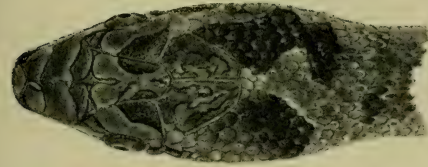
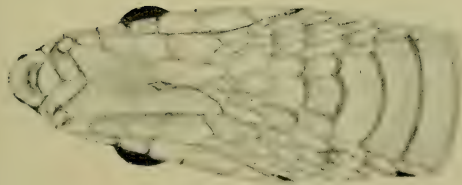
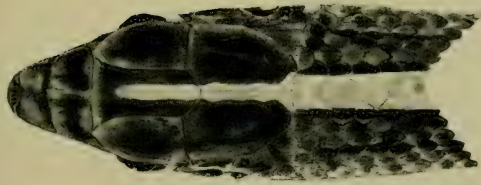
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PLATE XXVIII

Fig. 1. Dorsal, ventral, and lateral view of the head of *Coluber spinalis* Peters,
A. M. N. H. No. 28257, $\times 4$.

Fig. 2. Dorsal, ventral, and lateral views of head of *Elaphe dione* (Pallas).
A. M. N. H. No. 28258, $\times 2$.

1



2

PLATE XXIX

Fig. 1. *Eremias przewalskii* Stranch, A. M. N. H. Nos. 31510, ♀, 31512, ♂, and 31508, juv. To show pattern variation with age and sex.

Fig. 2. *Japalura splendida* Barbour and Dunn, A. M. N. H. No. 23552, ♀, 23553 and 23558, ♂. To show pattern variation with sex.



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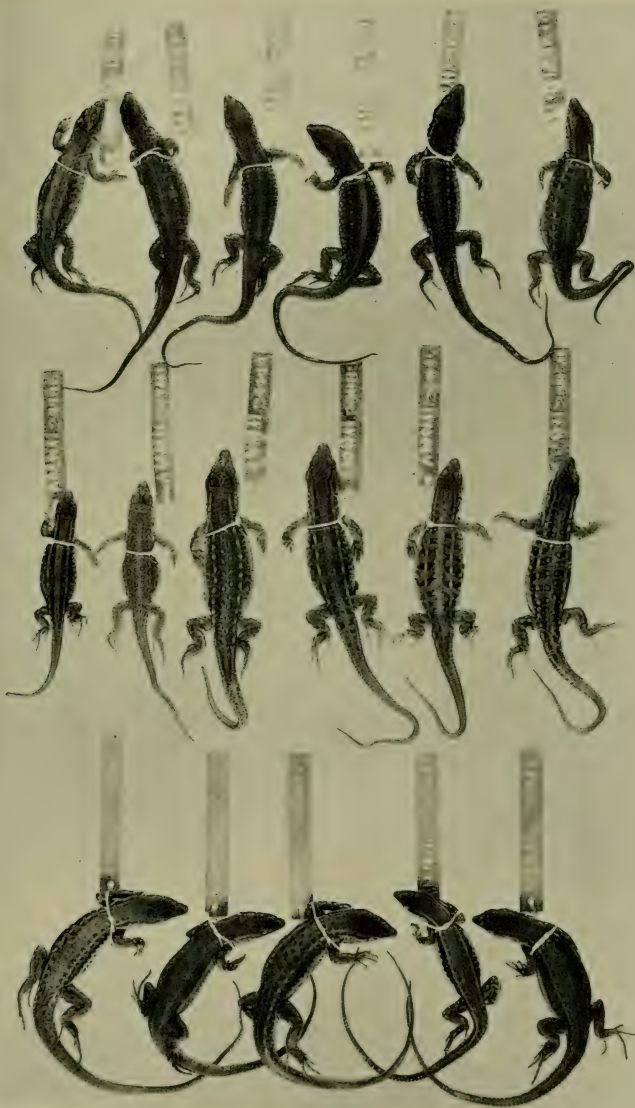
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PLATE XXX

Fig. 1. *Eremias argus* Peters, A. M. N. H. Nos. 21430, 21417, 21418, 21420, 21412, 21414. Pattern variation.

Fig. 2. *Eremias barbouri*, new species, A. M. N. H. Nos. 24115, 24101, 24111, 24089, 24047, 24050. Pattern variation.

Fig. 3. *Eremias brenchleyi* Gunther, A. M. N. H. Nos. 31409, 31413, 31404, 31408, 31412. Pattern variation.



1

2

3

Article V.—NOTES ON CHINESE AMPHIBIANS¹BY KARL PATTERSON SCHMIDT²

PLATES XXXI AND XXXII

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INTRODUCTION

The Chinese amphibians in The American Museum of Natural History, from all sources, number 1860 specimens, exclusive of the Hainan collection. Of these, 1389 were collected by the Third Asiatic Expedition; 173 were collected in Fukien by H. R. Caldwell; 82 were presented by Mr. J. W. Williams, of the College of Yale-in-China, Changsha, Hunan; 76 were collected by Mr. R. C. Andrews and Edmund Heller in Fukien and Yunnan, 1916-1917; 74 were purchased from the Rev. John Graham of Yunnanfu, Yunnan; 50 were purchased from Mr. Arthur Jacot, of Shantung Christian University, Tsinan, Shantung; 9 come from the Kreyenberg collection; 5 were presented by Mr. Makoto Nishimura; and two are from Mr. H. H. Johnson. Three specimens of a salamander of the genus *Batrachuperus*, presented to the Field Museum of Natural History by Mr. Robert B. Ekvall, Titao, Kansu, add a species to the list considered.

These specimens are distributed among the following families and genera:

| SALAMANDERS | | | |
|-----------------|------------|-------------|---------------|
| | No. Genera | No. Species | No. Specimens |
| Salamandridæ | 3 | 4 | 74 |
| Hynobiidæ | 1 | 1 | 3 |
| FROGS AND TOADS | | | |
| Discoglossidæ | 1 | 2 | 22 |
| Bufo | 1 | 5 | 373 |
| Hylidæ | 1 | 2 | 100 |
| Brevicipitidæ | 2 | 3 | 225 |
| Ranidæ | 2 | 22 | 1066 |

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 77.

²Of the Field Museum of Natural History.

The new forms are five in number.¹

| SPECIES | TYPE LOCALITY |
|------------------------------------|--------------------------|
| <i>Batrachuperus tibetanus</i> | Tibetan Border of Kansu. |
| <i>Bufo andrewsi</i> | Likiang, Yunnan. |
| <i>Rana nigromaculata mongolia</i> | Mai Tai Chao, Shansi. |
| <i>Rana noblei</i> | Yunnanfu, Yunnan. |
| <i>Rana caldwelli</i> | Yenping, Fukien. |

As in the case of previous papers on the collections of the Third Asiatic Expedition, I am indebted to Dr. Leonhard Stejneger of the United States National Museum and to Dr. Thomas Barbour, of the Museum of Comparative Zoölogy, for permission to examine specimens in their charge and for cordial aid and advice.

My connection with the present report results from a cordial co-operative agreement between the Field Museum of Natural History and The American Museum of Natural History, arranged at the instance of Mr. Roy Chapman Andrews, leader of the Third Asiatic Expedition.

ANNOTATED LIST OF SPECIES

CAUDATA

Hynobiidæ

Batrachuperus tibetanus, new species

TYPE.—A. M. N. H. No. 5900; adult female; Tibetan border of Kansu, at about latitude 33° N., elevation 9000 feet; December, 1923; Robert B. Ekvall.

DIAGNOSIS.—Closely allied to *Batrachuperus pinchonii*, from which it may be distinguished by the more posteriorly situated vomerine teeth; the more depressed head; the fourteen costal grooves; the absence of horny covering on the palms and soles, only the tips of the digits having a horny epidermis; the somewhat longer tail, .49–.52 of the total length; and the much lighter coloration.

DESCRIPTION OF TYPE.—Costal grooves, 14; the appressed toes overlap; head width 6 times, and head length $4\frac{1}{2}$ times in length from snout to vent; eye as long as its distance from tip of snout; a prominent labial fold on the upper jaw; a slight fold on the lower jaw; a shallow groove back of the eye; a well-marked groove from eye to gular fold; no groove to angle of jaw; gular fold extends on sides of neck to dorsal surface; limbs well developed, overlapping when appressed; fingers 2–3–4–1 and toes 3–2–4–1 in order of length; tips of digits covered with a thick horny epidermis, which is absent from the palms and soles; tail cylindrical at the base, flattened gradually to the tip, only the last one-fourth very flat; vent formed by the confluence of five grooves; much swollen; vomerine teeth 5–5, in slightly arched series beginning well within and slightly behind the internal nares and extending diagonally forward to the level of their anterior border; distance between the vomerine series about equal to the length of one of them; olive-gray above with indistinct black marbling.

MEASUREMENTS.—Body 85 mm.; tail 80 mm.; length head 18 mm.; breadth head 14 mm.; arm 23 mm.; leg 27 mm.

¹Diagnoses of these forms have appeared in Amer. Mus. Novitates, No. 157, February 13, 1925, and No. 175, May 28, 1925.

PARATYPES.—Two additional female specimens with the same data as the type agree with it in all essential characters.

RANGE.—Western Szechwan and Kansu, and borders of Tibet.

In recording a specimen of this genus from western Szechwan as *Batrachuperus sinensis* (Sauvage), (= *B. pinchonii* (David), cf. Stejneger 1925a, p. 5) in his valuable revision of the Hynobiidæ, Dunn describes in detail its differences from typical specimens of Mt. Omei *sinensis*. These had already been noted by Barbour in recording the same specimen for the first time (1912). While the locality is somewhat remote from that of the new specimens at hand, it seems very likely that this specimen, a male, belongs with the proposed *tibetanus*.

Salamandridæ

Tylototriton verrucosus Anderson

Two specimens, A. M. N. H. Nos. 5384–5385, were collected at Tengyueh, Yunnan, May 14, 1917, and one at Genkang, Yunnan, February 5, 1917, by R. C. Andrews and Edmund Heller.

Triturus orientalis (David)

A. M. N. H. Nos. 18549 and 21501–21506, collected at Ningkwo, Anhwei, September 28, 1921, by Clifford H. Pope.

One specimen, No. 18549, has a very smooth skin, in strong contrast with the remaining six specimens, and has a somewhat wider tail-fin. It thus strongly suggests an aquatic stage, while the more rugose specimens probably represent a terrestrial stage.

Measurements of two specimens.

| A. M. N. H. Nos. | 18549 | 21504, ♀ |
|------------------|--------|----------|
| Total Length | 72 mm. | 54 mm. |
| Head Length | 10 | 7 |
| Arm | 14 | 9 |
| Leg | 15 | 10 |

Triturus wolterstorffii Boulenger

A. M. N. H. Nos. 6560–6562, Yunnanfu, Yunnan, 1919, collected by John Graham.

Pachytriton brevipes (Sauvage)

Sixty-one specimens, collected in Fukien by H. R. Caldwell, as follows: A. M. N. H. Nos. 8097, 8099, 8123–29, 8131–32, 8134–35, 8143, Mountains near Yenping, August, 1920; and 18502–18548, Fukien Province, 1921–1922.

The ventral coloration in this series is highly variable. There is a tendency toward a mid-ventral longitudinal line. Juvenile specimens have much more sharply defined ventral markings.

Measurements of three specimens follow.

| A. M. N. H. No. | 18529 | 8126 | 18508 |
|-----------------|---------|---------|--------|
| Sex | ♂ | ♀ | juv. |
| Total Length | 173 mm. | 168 mm. | 88 mm. |
| Body | .82 | .85 | .43 |
| Head | 21 | 21 | 12 |
| Tail | 19 | 83 | 45 |
| Arm | 18 | 17 | 11 |
| Leg | 21 | 21 | 13 |

The reference to this species by Werner (1924, p. 49) is evidently a *lapsus* for *Batrachuperis pinchonii* (David). His synonymy refers to the latter species.

SALIENTIA

Discoglossidæ

Bombina orientalis (Boulenger)

Five specimens of this species were presented to the American Museum by Mr. Makoto Nishimura; A. M. N. H. Nos. 5168-5169, Sokako in Amposen, Manchuria, and 5180-5182, Mukden, Manchuria.

Bombina maxima (Boulenger)

Seventeen specimens of this form are in the American Museum collection. A. M. N. H. Nos. 5445, 5447, Yunnanfu, 6550-6552, Hsin-shao, and 8144, Wutingchow District, were collected by John Graham in Yunnan. A. M. N. H. Nos. 5749-5759 were taken at Likiang, 8500 feet altitude, Yunnan, October 4, 1916, by R. C. Andrews and Edmund Heller.

Males of this species are apparently without vocal sacs and without asperities on the toes. The first, second, and third fingers, the metacarpal tubercle, and the inner face of the forearm are provided with horny nuptial asperities. The metacarpal tubercle is much enlarged in the males and scarcely evident in the females. In one specimen the asperities are wanting on the third finger of one side.

Bufonidæ

Bufo melanostictus Schneider

A. M. N. H. Nos. 674 comes from Pinghsiang, Kiangs; 18444, Yenping, Fukien, and 18467-18570, 18559-18565, Fukien Province, collected by H. R. Caldwell; and 5386-5407, 6313, Tengyueh, Yunnain, May, 1917, R. C. Andrews and Edmund Heller.

The Yunnan specimens differ somewhat from the Fukien series in having a more thickened supraorbital crest, which is decidedly crenulate in two specimens.

***Bufo bankorensis* Barbour**

Eighty-one specimens are referred to this species as follows: A. M. N. H. Nos. 11306, 11308, 11309, 11311, Base of Tei Pei Shan, Tsing Ling Mts., Shensi, October, 1921; 13158, 13162, 13164-13165, Chikungshan, Honan, August 26, 1918, J. W. Williams; 13153-13154, 13163, 13169-13170, 13172-13175, 13177-13178, 13180-13181, 13188-13190, Changsha, Hunan, 1919, J. W. Williams and K. F. Yan; 18649-18650, Shengchorefu, Hunan, H. H. Johnson; 18440, 21928-21954, Ningkwo, Anhwei, September-October, 1921, and 21507-21533, Wuhu, Anhwei, September-October, 1921, collected by Clifford H. Pope; 18597, Yenchingkau, Szechwan, October, 1921, and 18441-18443, Luanshikau, Szechwan, September, 1921, collected by Walter Granger.

I am fully convinced that if *Bufo gargarizans* of Chusan Island and *Bufo asiaticus* of Shanghai are both placed as subspecies of *Bufo bufo*, they must be considered synonymous. The question of the identity of the present form however, is far from clear, as it strongly approaches *Bufo bankorensis* Barbour, described from Formosa. The larger specimens in the present series all have a perfectly smooth head, while juvenile specimens, and occasional half-grown specimens, are scarcely distinguishable from the northern form of *Bufo bufo* on this character.

The ventral coloration in this series is not evidently correlated with any other character. In the Anhwei series, of twenty-one juvenile specimens, one has very small, but distinct black dots; nine have well-defined black markings; and eleven are immaculate or with very indistinct or very few spots. In sixteen males, seven have rather distinct black markings; six have indistinct or very few spots, mostly posterior if present; and three are unspotted. In seventeen females, seven have well-defined black markings, and ten are nearly free from ventral spots. When the most strongly marked of these specimens are directly compared with the Shansi series, it is found that those from Anhwei are much less extensively and less intensely black than the northern species.

General smoothness of body appears as an occasional variation, and does not appear to be correlated with variation in coloration or in measurements.

The head of *Bufo bufo japonicus* appears to be more rounded when viewed from beneath, with a larger mouth. I have measured the distance

between the rictal angles and the vertical distance between the latter line and the front of the mouth to show this character. The ratio between the two characters appears as mouth proportion in the tabulation.

| SUMMARY OF MEASUREMENTS | | | | |
|-------------------------|-----|---------------|------------|---------|
| | Sex | No. Specimens | Extremes | Average |
| Body Length | ♂ | 10 | 75-115 mm. | 86 mm. |
| | ♀ | 10 | 85-114 | 99 |
| Leg/Body | ♂ | 10 | 1.17-1.47 | 1.35 |
| | ♀ | 10 | 1.11-1.31 | 1.20 |
| Width Head/Body | ♂ | 10 | .35-. 39 | .37 |
| | ♀ | 10 | .35-. 40 | .38 |
| Length Foot/Leg | ♂ | 10 | .31-. 36 | .35 |
| | ♀ | 10 | .32-. 37 | .33 |
| Mouth Proportion | ♂ | 10 | .41-. 52 | .45 |
| | ♀ | 10 | .41-. 47 | .44 |

A singular problem is presented by the distribution of the common toads of central China. It seems evident that the common species at Shanghai and in the provinces of Chekiang is a subspecies of *Bufo bufo*, while at Ningkwo and Wuhu, in Anhwei, the sole and very abundant species is *Bufo bankorensis*. A specimen of *bankorensis* in the Field Museum of Natural History received from Dr. C. Ping, Nanking, and the record of *Bufo bufo asiaticus* from the same locality and source by Stejneger (1925a, p. 7) indicate that both species occur in the vicinity of Nanking, and the two species are recorded from several localities in Szechwan.

Twenty stomachs contained food: twelve contained beetles or beetle fragments; five contained unidentified insect remains; four, ants; three, grasshoppers; three, millipedes; two, snails; two, plant remains; one (each), remains of a small toad, earwig fragments, spiders, and centipede fragments.

***Bufo bufo japonicus* (Schlegel)**

Thirty-two specimens are referred to this form: A. M. N. H. Nos. 11307, 11310, 18439, Peking, Chihli, October-November, 1921; 14551-14569, 14682, Hsing Lung Shan, Chihli, August, 1921; and 17882-17890, Kwei Hwa Cheng, Shansi, June 1-10, 1922, all collected by Clifford H. Pope.

The differences between this series and the common toad of central China have been noted above. I have referred them to *japonicus* because of the strongly maculate venter, the chief character emphasized by Stejneger for this form.

SUMMARY OF MEASUREMENTS

| | Sex | No. Specimens | Extremes | Average |
|------------------|-----|---------------|------------|---------|
| Body Length | ♂ | 7 | 80-103 mm. | 88 mm. |
| | ♀ | 5 | 71- 99 | 84 |
| Leg/Body | ♂ | 7 | 1.32- 1.46 | 1.38 |
| | ♀ | 5 | 1.13- 1.42 | 1.26 |
| Width Head/Body | ♂ | 7 | .35- .40 | .37 |
| | ♀ | 5 | .38- .42 | .39 |
| Foot/Leg | ♂ | 7 | .30- .40 | .36 |
| | ♀ | 5 | .29- .34 | .33 |
| Mouth Proportion | ♂ | 7 | .52- .64 | .59 |
| | ♀ | 5 | .50- .61 | .55 |

Bufo andrewsi, new species

Plate XXXII, Figure 3

TYPE.—A. M. N. H. No. 5769; Likiang, 8500 feet altitude, Yunnan; October 4, 1916; R. C. Andrews and Edmund Heller.

DIAGNOSIS.—Closely allied to *Bufo bufo* from which it is distinguished by the presence of a tarsal fold, its finer and more uniform tuberculation, the less divergent parotids, and the tuberculate top of the head.

DESCRIPTION OF TYPE.—Head moderately wide, flat above; nostrils about equidistant from the point of the snout and the eyes, the distance between them about equal to their distance from the labial border and from the upper eyelid; tympanum distinct, vertically oval, its greatest diameter about equal to its distance from the eye; parotid glands large, slightly less than twice as wide, nearly parallel; arms rather long; first and second fingers equal; two large palmar tubercles, the smaller with nuptial asperities, which are also present on the upper surfaces of the first and second fingers and on the inner side of the third; subarticular tubercles of fingers not divided; heels barely meeting when the legs are placed at right angles to the body; toes webbed, the web extending as far as the end of the two basal phalanges of the third and of the first phalanx of the fourth toes; web extending as a narrow border to the tips of the toes, outer side of fifth toe with a similar "fin"; inner metatarsal tubercle rounded, about as long as wide, brown, one-half the length of the first toe; outer tubercle small; subarticular tubercles beneath the third and fourth toes divided; a well-defined tarsal fold, not reaching the heel; plantar and palmar tubercles smooth, without asperities. Upper surface covered with small spinose warts, some of which are confluent into elongate crests which form a well defined lateral row and a less distinct A-shaped group between the posterior ends of the parotids; a group of enlarged

tubercles behind the rictus; top of head tuberculate; the tubercles, except when multi spinose, all smaller than the tympanum; belly covered with rather uniformly set low tubercles, each faintly horny at its tip.

Nearly uniform dark brown above, with faintly suggested darker longitudinal bands; lower half of the parotid black; belly a little lighter brown, with distinct rather small black spots, uniformly distributed; similar spots on the lower surfaces of the limbs.

MEASUREMENTS

| A. M. N. H. Nos. | 5769, Type | 5767 | 5773 |
|-------------------|------------|--------|--------|
| Sex | ♂ | ♀ | juv. |
| Snout to Anus | 71 mm. | 82 mm. | 36 mm. |
| Snout to Tympanum | 16.5 | 21 | 9.5 |
| Width of Head | 23.5 | 29 | 12 |
| Tympanum | 3.0 | 4.0 | 2.0 |
| Arm | 48 | 50 | 24 |
| Leg | 93 | 100 | 43 |
| Tibia | 27 | 33 | 15 |
| Hindfoot | 34 | 34 | 14 |

PARATYPES.—Seven specimens, A. M. N. H. Nos. 5767–5768, 5770–5774 were collected at Likiang with the type. Six additional specimens received from the Rev. John Graham in Yunnan bear the following localities: Nos. 5449 and 12942–12943, Yunnanfu; 6553, Muyang, 40 miles N. of Yunnanfu; and 6593–6594, Wutingchow District.

Werner records six specimens of a *Bufo* from between “Yungning Yüingbei, and Lidjiang” in Yunnan as *Bufo vulgaris asiaticus*. He comments on their small size and on the frequent presence of a tarsal fold. These specimens appear to be plainly referable to the species above described. Stejneger's *Bufo minshanicus* (1926, p. 446) appears to be allied to this form.

Bufo raddei Strauch

Two hundred and six specimens: A. M. N. H. Nos. 17891–18094, Mai Tai Chao, (43 miles S. E. of Paotowchen), Shansi, May, 1922, and 22074, Chen Tzu, Taiyuanfu, Shansi, August, 12, 1922, collected by Clifford H. Pope; and 906, Tsingta, Shantung.

Mr. Pope found this species breeding from May 6 to May 22 in northern Shansi. He comments on the striking differences between the sexes.

Perhaps owing to their capture during the breeding season, the majority of stomachs examined were empty. Five stomachs contained food, which was composed of beetle remains, among which snout beetles, Scarabidæ, and Carabidæ form the great proportion.

***Hyla chinensis* Günther**

A. M. N. H. Nos. 18471, Fukien Province, 18611-18616, Yenping, Fukien, collected by H. R. Caldwell; 5418, Futsing, Fukien, July 28, 1916, R. C. Andrews and Edmund Heller; 5304-5306, 5430-5435, 12944-12945, Yunnanfu, Yunnan, and 6590, Wutingchow District, Yunnan, collected by John Graham.

No. 18471 has the lateral spots confluent into two longitudinal bars with downward projections. In No. 5418 the dark spots are nearly completely fused into a lateral line.

I am unable to find characters to distinguish the Yunnan specimens from the Fukien series.

***Hyla immaculata* (Boettger)**

A. M. N. H. Nos. 18586, 21743-21790, Wuhu, Anhwei, and 21791-21822, Ningkwo, Anhwei, collected by Clifford H. Pope, September-October, 1921.

Dusky crossbars on the hind limbs are present in only one specimen in the large series at hand. The white lateral line is nearly always distinguishable on the sides of the body, and may extend from the canthus, over the edge of the upper eyelid, and over the tympanum, to the groin, widening somewhat on the sides. A second light line from the nostril, below the eye and tympanum may occasionally be distinguished. The white line above the very narrow dark border of the upper lip is sometimes sharply defined, and usually forms a loop in front of the shoulder and just below and behind the tympanum.

***Kaloula borealis* (Barbour)**

A. M. N. H. Nos. 14827-14937, 26 miles S. of Hsing Lung Shan, Eastern Tombs, Chihli, August 14, 1921, Clifford H. Pope.

Beyond a slight difference in the amount of web, I am unable to find any character to distinguish *Kaloula wolterstorffii* Stejneger (1925, p. 151) from this species. Wolterstorff's Shantung record of *Kaloula verrucosa* must certainly be referred to *borealis*, whose type locality is Antung, Manchuria, directly across Korea Bay from Chefoo. Such a distribution coincides with that of *Bombina orientalis* and *Bufo raddei*, and I am informed by Prof. Arthur Jacot, of Shantung Christian University, that this is a normal faunal relation, characteristic of other groups of animals also. The receipt of a specimen of *Bombina orientalis* from Nanking (the type locality of *Kaloula wolterstorffii*) suggests that both may be transported specimens. The Chinese penchant for the trans-

portation of odd-looking animals, and their use in the *materia medica*, requires a verification of all unusual locality records.

Callula tornieri Vogt may be expected to prove identical with this species, which would in that event be known from Korea, Manchuria, Chihli, and Shantung.

As in so many Brevicipitidae, the diet of this species shows a strong preponderance of ants. Of forty stomachs examined, twenty contained food, and of these seventeen contained ants or ant remains, five contained beetles or their wing covers, and one contained plant remains, seeds, and small fragments of a fruiting spikelet.

Kaloula verrucosa (Boulenger)

A. M. N. H. Nos. 3135, 5292-5298, 5300-5303, 6432, and 12946-12947, Yunnanfu, Yunnan, collected by the Rev. John Graham.

There seems to be no question of the entire distinctness of *verrucosa* from *borealis*. The Shantung records of *verrucosa* are probably to be placed with *borealis*.

Microhyla eremita Barbour

A. M. N. H. Nos. 5795-5796, Pinghsiang, Kiangsi; 13226, Changsha, Hunan, April 22, 1918, J. W. Williams; 22070, Huping College, Yochow, Hunan, 1922, Clifford H. Pope; and 21823-21927, Ningkwo, Anhwei, September-October, 1921, Clifford H. Pope.

Rana rugulosa Wiegmann

A. M. N. H. Nos. 18456, Yenping, Fukien, H. R. Caldwell; 22048-22069, Ningkwo, Anhwei, September-October, 1921, Clifford H. Pope; 13151-13152, 13155-13157, 13159-13161, 13166-13168, 13171, 13176, 13179, Changsha, Hunan, J. W. Williams and K. F. Yan.

The single specimen from Fukien agrees closely with a series from Formosa in the American Museum, and differs from the Anhwei and Hunan specimens in coloration and in having more numerous and longer glandular ridges. It seems possible, however, that these differences are due in part to different preservation.

Rana limnocharis Wiegmann

Two hundred and sixty-six specimens represent this common species. A. M. N. H. Nos. 5417, Futsing, Fukien, July 28, 1916, R. C. Andrews and Edmund Heller; 18472-18475, 18486-18487, 18573-18577, Fukien Province, and 8083-8091, 18620-18621, Yenping, Fukien, collected by

H. R. Caldwell; 18552-18558, 18622-18631, Wanhsien, Szechwan, September, 1921, and 18598, 18602, 18582, 18585, Yenchingkau, Wanhsien, Szechwan, October, 1921, collected by Walter Granger; 18583, Yochow, Hunan, March 3, 1922; 18584, 21959-31964, Ningkwo, Anhwei, September-October, 1921, 21562-21728, Wuhu, Anhwei, September-October, 1921, and 22075-22100, locality doubtful (probably Ningkwo), collected by Clifford H. Pope; 13193-13195, 13197, 13202, 13205-13210, 13213-13215, 13219, 13232-13234, Changsha, Hunan, 1918-1919, J. W. Williams; 13198, Nanking, Kiangsu, April 17, 1918, J. W. Williams; and 13216-13217, Chikungshan, Honan, August 21, 1918, J. W. Williams.

***Rana phrynoides* Boulenger**

A. M. N. H. Nos. 5428-5429, Yunnanfu, Yunnan, December 15, 1917; and 8149-8150 Wutingchow District, Yunnan, July 26, 1920, Rev. John Graham.

No. 8149, 68 mm. in length, lacks the spines on the breast, though they are present on the fingers. As I find no other differences, this is probably a seasonal or age variation.

No. 8150 has a number of distome trematode parasites attached by means of raised papillæ behind the tongue.

***Rana spinosa* David**

Fifteen specimens, A. M. N. H. Nos. 669, Pinghsiang, Kiangsi; 5410-5415, Futsing, Fukien, July 28, 1916, R. C. Andrews and Edmund Heller; and 8082, 18450-18455, 18457, Yenping, Fukien, H. R. Caldwell.

No. 669 has no pectoral spines and none on the third finger. It measures 70 mm., and thus apparently presents a parallel to the condition of the spines in the half-grown male *phrynoides* noted above.

***Rana plancyi* Lataste**

A. M. N. H. Nos. 13204, Changsha, Hunan, July 9, 1919, J. W. Williams, and 21548-21561, 21729-21736, Wuhu, Anhwei, and 21955-58, Ningkwo, Anhwei, September-October, 1921, Clifford H. Pope.

***Rana nigromaculata nigromaculata* (Hallowell)**

Plate XXXI, Figure 2

One hundred-thirty five specimens, A. M. N. H. Nos. 14683-14818, collected 26 miles south of Hsing Lung Shan, Chihli, August 12, 1921, by Clifford H. Pope, and about thirty tadpoles in various stages of transformation, with the same data, A. M. N. H. No. 14819. Fifty

specimens, Nos. 11326–11375, collected by Arthur Jacot at Tsinan, Shantung, are also to be placed with this form.

The relations of this form are discussed below, under *Rana nigromaculata mongolia*.

Our Shantung specimens apparently agree closely with the Japanese specimens examined by Stejneger. The Hsing Lung Shan series does not contain adult specimens, but I have little hesitation in placing it with the Shantung and Japanese subspecies, with which it agrees in the character of the metatarsal tubercle. Typical *nigromaculata* is, therefore, restricted to Japan, Korea, Chihli, and Shantung, with the probable addition of the Siberian Coast Province and Manchuria.

***Rana nigromaculata reinhardtii* (Peters)**

Plate XXXI, Figure 1

One hundred and six specimens are here recognized as a subspecies of *nigromaculata* in south and central China. They were collected as follows: A. M. N. H. No. 666, Pinghsiang, Kaingsi; 8066–8079, 18478, 18481–18484, 18578–18581, Fukien Province, and 8092–8093, 18446–18448, near Yenping, Fukien, collected by H. R. Caldwell; 18458–18466, 18599–18601, 18603–18610, Yenchingkau, Wanhsien, Szechwan, October, 1921, and 18587–18591, 18632, Wanhsien, Szechwan, 1921, collected by Walter Granger; 21534–21547, 21737–21742, Wuhu, Anhwei, and 21965–21983, Ningkwo, Anhwei, collected September–October, 1921, by Clifford H. Pope; 13182–13186, 13191, 13199–13201, 13227–13228, 13231, Changsha, Hunan, J. W. Williams and K. F. Yan.

The relations of this form are discussed below, in connection with the following subspecies.

I have followed Stejneger in preferring to disregard the name *chinesis* Osbeck as unidentifiable. Peter's description of *Hoplobatrachus reinhardtii* mentions the pointed snout which characterizes the present series, and I propose that this name be employed for a subspecies of *nigromaculata* in the Yangtze Valley and Fukien.

***Rana nigromaculata mongolia*, new subspecies**

Plate XXXI, Figure 3

TYPE.—A. M. N. H. No. 18149; ♂; Mai Tai Chao, Shansi, May, 1922, Clifford H. Pope.

DIAGNOSIS.—Derived from *Rana nigromaculata nigromaculata*, from which it differs in having a much more rugose skin, with very short longitudinal folds, shorter legs, especially the tibia, a relatively broader head, and a different style of coloration.

DESCRIPTION OF TYPE.—Vomerine teeth in two rounded groups between the choanae, their distance from the latter about equal to the distance between them;

nostrils a little nearer the eye than the tip of the snout; distance between nostrils a little less than their distance from the orbits; interorbital space half the width of the upper eyelid; diameter of tympanum equals that of the orbit, and is four times its distance from the latter; first finger a little longer than the second, swollen at the base and provided with a very large velvety pad; toes nearly completely webbed, the web very narrow on the last phalanx of the fourth toe; outer metatarsals well separated; tips of digits tapering, rounded, not at all expanded or grooved; sub-articular tubercles distinct; inner metatarsal tubercle large, with a horny edge, its length nearly equal to that of the fifth toe; an indistinct outer tubercle; no tarsal fold; heels not meeting when the limbs are placed at right angles to the body; a well-defined but irregular and rugose dorsolateral fold, from the eyelid to the hip, its breadth at some points greater than that of the interorbital space; dorsal skin coarsely granular, with five irregular longitudinal folds between the dorsolateral folds; a strong glandular fold from the tympanum above the vocal sac to a point considerably behind the insertion of the arm; vocal sacs external, below and behind the tympanum.

Grayish olive above, with faint transverse black markings; limbs with darker crossbars; lower side immaculate; a paler mid-dorsal line, with no trace of paler lines on the dorsolateral fold.

MEASUREMENTS

| A. M. N. H. No. | 18175, Type | 18149 |
|---------------------|-------------|--------|
| Sex | ♂ | ♀ |
| Snout to Vent | 69 mm. | 65 mm. |
| Width of Head | 26 | 25 |
| Tympanum | 7 | 6 |
| Arm | 36 | 38 |
| Leg | 105 | 104 |
| Tibia | 30 | 30 |
| Foot | 37 | 39 |
| Metatarsal Tubercle | 6.0 | 7.0 |
| Fifth Toe | 6.5 | 7.0 |

PARATYPES.—The twenty-eight paratypes: A. M. N. H. Nos. 18096–18104, Kwei Hwa Cheng, Shansi, June 1–10, 1922; 18122, 18127, 18129, 18132, 18146, 18149, 18168, 18173–18175, 18179–18180, 18182, 18191, 18204, 18213, 18216, 18222, Mai Tai Chao, Shansi, May, 1922; and 11304–11305, base of Tei Pei Shan, Tsing Ling Mts., Shensi, October, 1921, are all in the collection of the Third Asiatic Expedition made for the most part by Clifford H. Pope.

The only noteworthy variation in this series is seen in the two specimens from Shensi, which are distinctly longer legged than the Shansi specimens. They agree with the latter in width of head, dorsal rugosity, and character of the metatarsal tubercle.

COMPARATIVE TABLE OF MEASUREMENTS OF THE SUBSPECIES OF *Rana nigromaculata*

| | Sex | Length of Body in mm. | | | Leg/Body | | | Tibia/Body | | | Width Head/Body | | |
|----------------------------|-----|--------------------------|----------|------|--------------|-----------|------|--------------|----------|------|-----------------|----------|------|
| | | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean | No. Spec. | Extremes | Mean |
| Shansi Series | ♂ | 9 | 62-69 | 65 | 9 | 1.46-1.59 | 1.53 | 9 | .43-.48 | .46 | 9 | .36-.38 | .37 |
| | ♀ | 9 | 34-80 | 55 | 9 | 1.44-1.62 | 1.52 | 9 | .43-.46 | .44 | 9 | .35-.41 | .38 |
| Shantung Series | ♂ | 10 | 53-63 | 57 | 10 | 1.56-1.76 | 1.62 | 10 | .46-.54 | .49 | 10 | .33-.38 | .36 |
| | ♀ | 10 | 57-65 | 61 | 10 | 1.53-1.69 | 1.60 | 10 | .45-.51 | .49 | 10 | .33-.37 | .35 |
| Anhwei and Szechwan Series | ♂ | 10 | 54-72 | 62 | 10 | 1.49-1.69 | 1.59 | 10 | .48-.54 | .51 | 10 | .31-.36 | .34 |
| | ♀ | 10 | 65-95 | 76 | 10 | 1.54-1.73 | 1.62 | 10 | .47-.54 | .51 | 10 | .32-.37 | .34 |
| Fukien Series | ♂ | 10 | 55-67 | 62 | 10 | 1.58-1.71 | 1.64 | 10 | .49-.52 | .51 | 10 | .32-.36 | .33 |
| | ♀ | 10 | 56-85 | 65 | 10 | 1.51-1.71 | 1.64 | 10 | .48-.56 | .52 | 10 | .31-.34 | .33 |

The specimens of *Rana nigromaculata mongolia* are well distinguished from the Shantung series at hand by their much greater rugosity and apparently different style of coloration, as well as by a considerable difference in measurements. The Shansi series agrees with the Shantung specimens in the length of the metatarsal tubercle, and both differ in this character from the south Chinese specimens. These differences may be expressed in key form as follows.

A.—Snout pointed, projecting; metatarsal tubercle much shorter than the fifth toe; size large; spots distinct, transverse; (south and central China).

nigromaculata reinhardtii.

AA.—Snout rounded, little projecting; metatarsal tubercle nearly or quite as long as the fifth toe; size moderate; spots often square or longitudinal, or absent in the adult.

B.—Back rather smooth, with longitudinal ridges; tibia about half the length of the body; limbs longer, head narrower; (Japan, Chihli, Shantung, etc).

nigromaculata nigromaculata.

BB.—Back very rugose, ridges irregular; tibia always less than half the length of the body; limbs shorter, head wider; (Shansi, Shensi, and Inner Mongolia).....*nigromaculata mongolia*.

Rana noblei, new species

Plate XXXII, Figure 1

TYPE.—A. M. N. H. No. 5285; ♀; Yunnanfu, Yunnan; John Graham.

DIAGNOSIS.—Allied to *Rana nigromaculata*, from which it is distinguished by its more rounded snout, absence of dorsal folds between the dorsolateral folds, smaller metatarsal tubercle, and very different coloration.

DESCRIPTION OF TYPE.—Width of head equal to the distance from the snout to posterior border to the tympanum; snout broadly rounded, nearly vertical in front, not projecting; interorbital space about one-half the width of the upper eyelid; vomerine teeth in two closely approximated transverse groups between the choanæ tympanum large, very distinct, its diameter slightly greater than the distance between the nostrils; the latter about equidistant from the eyes and point of the snout. First and second fingers equal; tibio-tarsal articulation reaching the eye; heels broadly overlapping when the legs are placed at right angles to the body; tips of digits not dilated; outer metatarsals separated nearly to their bases; toes broadly webbed, the two distal phalanges of the fourth free; inner metatarsal tubercle small, rounded, its length less than half that of the first toe; a small but distinct outer metatarsal tubercle; a strong tarsal fold or ridge from the inner tubercle to the heel, and a less sharply defined one from the base of the fifth toe to the heel. Back with broad dorsolateral glandular folds, continuous from the upper eyelids to the hips, two-thirds the width of the eyelid, which is strongly pitted like the fold; a short glandular fold below the tympanum to a point above the insertion of the arm; very low, rounded and smooth glandular areas between the dorsal folds, with no longitudinal ridges.

Reddish brown above and below, with small sharply defined black spots on the back; a black spot at the base of each arm, a black mark behind the elbow, and one

on the front of the forearm; hind limbs without crossbars, with obscure dark mottling on the posterior face of the thighs.

MEASUREMENTS

| | |
|-------------------|--------|
| Snout to Anus | 91 mm. |
| Snout to Tympanum | 22 |
| Width of Head | 28 |
| Tympanum | 7 |
| Arm | 48 |
| Leg | 146 |
| Tibia | 51 |
| Foot | 49 |

This species may represent *Rana nigromaculata* in the Yunnan area. I am unable to identify it with any of the south-Asian frogs listed in Boulenger's revision of 1920.

Rana japonica (Günther)

A. M. N. H. Nos. 18551, 18592-18595, 18617-18619. Wanh sien, Szechwan, 1921, collected by Walter Granger.

These eight specimens are notably distinct from all of the remaining Chinese wood-frogs in the American Museum's collection in having a perfectly straight dorsolateral fold. I do not, however, find any other characters whereby they can be distinguished.

Rana japonica auct.

A. M. N. H. Nos. 13187, 13202, 13212, 13230, Changsha, Hunan, 13196, 13220-13225, Nanking, Kiangsu, and 13229, Chikungshan, Honan, collected by J. W. Williams; 18550, 21984-22047, Ningkwo, Anhwei, September-October, 1921, collected by Clifford H. Pope; 22072, Yenping, Fukien, collected by H. R. Caldwell.

The Hunan, Kiangsu, and Anhwei specimens are certainly referable to a single species, and they represent the form which has been commonly referred to *Rana japonica*. Stejneger's revision of the Japanese wood-frogs (1924, p. 73) apparently leaves this form nameless. It is allied to *Rana asiatica* and *Rana amurensis* in having an angulate dorsolateral fold, but it is well distinguished from these species by its more slender habitus, narrower head, and paler coloration. It seems possible that *Rana cheuchinensis* David should be used for this species rather than for *R. amurensis*.

The degree of angularity of the lateral fold is certainly subject to variation in this series.

***Rana longicrus* Stejneger?**

A. M. N. H. No. 668, Pinghsiang, Kiangsi; 8094-8095, 22071, near Yenping, Fukien, and 18476-18477, Fukien Province, H. R. Caldwell.

These specimens have a decidedly more slender appearance than the common wood frog of the Yangtze Valley, but it is difficult to find definable characters to separate the two forms. The slenderness of the tibia is perhaps the best differentiating character. The length of the leg ranges from 1.86 to 2.00 times the length of the body, compared with a range of 1.7 to 2.09 in the so-called *japonica*. There is no trace of grooves on the slightly dilated tips of the digits. The width of the head at the angles of the mouth divided by the length from snout to anus, ranges from .29 to .32, averaging .30.

The course of the dorsolateral fold is somewhat angular, and the specimens at hand are thus apparently excluded from *longicrus* as defined by Stejneger. The Fukien specimen recorded as *longicrus* by Boulenger (1920, p. 95) doubtless belongs here. Like the central Chinese "*japonica*," they are apparently without a name. I have refrained from proposing additional names for these two forms in the hope that a more adequate study of the whole "wood-frog problem" may be made in the future.

***Rana amurensis* Boulenger**

A. M. N. H. Nos. 14570-14681, 14820-14826, Hsing Lung Shan, Chihli, August, 1921, Clifford H. Pope.

This series differs from the large Shansi series in having a shorter web and narrower dorsolateral fold, and I therefore have little hesitation in referring them to *amurensis*.

***Rana asiatica* (Bedriaga)**

One hundred and three specimens in the collection, all from Northern Shansi, collected by Clifford H. Pope, May-June, 1922. A. M. N. H. Nos. 18105-18118, Kwei Hwa Cheng; 22073, 18119-21, 18123, 18126, 18128, 18130-18131, 18133-18145, 18147-18148, 18150-18167, 18169-18172, 18176, 18178, 18181, 18183-18190, 18192-18203, 18205-18212, 18214-18281, 18217-18221, 18223-18224, Mai Tai Chao.

This species has the angular course of the dorsolateral fold behind the eye well marked. The only notable variation is in the amount of the dorsal black markings and in the extent of the lateral granulation of the skin.

***Rana pleuraden* Boulenger**

Forty-four specimens in the American Museum's collection represent this species. A. M. N. H. Nos. 5775-5791, Likiang, Yunnan, October 4, 1916, collected by R. C. Andrews and Edmund Heller; 5286-5291, 5427, 5436-5444, 5763-5764, and 13451-13453, Yunnanfu, Yunnan, and 6528, 6591-6592, 8145-8147, Wutingchow District, Yunnan, collected by John Graham.

The Likiang specimens agree excellently with the topotypes from Yunnanfu.

***Rana grahami* Boulenger**

A. M. N. H. Nos. 5284, Yunnanfu, Yunnan, John Graham, and 5766, Likiang, Yunnan, October 4, 1916, collected by R. C. Andrews and Edmund Heller, represent this species.

The resemblance of this form to *Rana andersonii* is extraordinary. It apparently replaces the latter in the central Yunnan area. The Likiang specimen extends the known range of *grahamii* to the northward, as it has hitherto been recorded only from Yunnanfu.

***Rana guentheri* Boulenger**

Four specimens in the collection: A. M. N. H. Nos. 667, Pinghsiang, Kiangsi; 5419-5420, Futsing, Fukien, July 28, 1917, R. C. Andrews and Edmund Heller; and 18596, Luanshikau, Wanhsien, Szechwan, September, 1921, collected by Walter Granger.

These specimens agree with Boulenger's figure (1882, Pl. iv, fig. 2) except for a somewhat shorter body, and with his most recent description (1920, p. 133). The coloration of *guentheri* suggests that of *plancyi*, the two perhaps forming a pair somewhat like *R. grahami* and *R. andersoni*, or *R. adenopleura* and *R. pleuraden*.

Rana caldwelli*, new species*Plate XXXII, Figure 2**

TYPE.—A. M. N. H. No. 18485; ♂; Fukien Province (probably near Yenping); H. R. Caldwell.

DIAGNOSIS.—Allied to *Rana adenopleura*, from which it is distinguished by having a more projecting snout, rougher skin, and the dorsolateral glandular folds broken up posteriorly.

DESCRIPTION OF TYPE.—Vomerine teeth in small oblique groups between the choanae, nearer to each other than to the latter.

Head a little broader than long; snout obtusely pointed, projecting well beyond the mouth, longer than the eye; canthus rostralis obtuse; loreal region moderately

oblique, concave; nostril equidistant from eye and tip of snout; distance between the nostrils greater than the interorbital width; tympanum very distinct, five-sixths the diameter of the eye, and four times its distance from the latter.

Fingers rather slender, with slightly swollen tips, with a rather indistinct groove on each side; first a little longer than the second; subarticular tubercles prominent.

Hind limb long, the heel reaching the tip of the snout; heels strongly overlapping when the legs are placed at right angles to the body; tibia a little less than twice in the length from snout to vent; toes slender, the tips dilated into small discs with sharply defined lateral grooves, moderately webbed, two and a half phalanges of the fourth toe free; outer metatarsals separated nearly to their base; a tarsal fold present; inner metatarsal tubercle about two-fifths the length of the inner toe; a small round outer metatarsal tubercle.

Skin finely rugose; a moderately broad glandular fold from above the tympanum to the groin, broken up posteriorly; the distance between the folds, on the middle of the back, four and one-half times in the length from snout to vent.

Grayish brown above, with a light vertebral line; a distinct dark band on each side of the head passing through the eye; dorsolateral fold dark edged; limbs with dark crossbars; hinder side of thighs light, marbled with brown; lower parts white, throat brownish; a black mark at the base of the arm, and one at the groin.

The first finger has a feeble pad, covered with a velvet-like grayish layer, on its inner side; a large flat gland, above and behind the axilla, is present.

MEASUREMENTS OF TYPE AND PARATYPE

| A. M. N. H. No. | 18485 | 18572 |
|-------------------|--------|--------|
| Snout to Vent | 49 mm. | 31 mm. |
| Snout to Tympanum | 14 | 10 |
| Width of Head | 18 | 10 |
| Tympanum | 5 | 3 |
| Arm | 33 | 20 |
| Leg | 90 | 60 |
| Tibia | 28 | 19 |
| Foot | 29 | 19 |

PARATYPE.—A. M. N. H. No. 18572, with no other data than Fukien Province, agrees closely with the type.

This species is apparently the mainland representative of the Formosan *R. adenopleura*. A specimen from Yenping has been recorded by Stejneger under the latter name (1925a, p. 23).

Rana andersonii Boulenger

Two specimens from western Yunnan, A. M. N. H. Nos. 5408–5409, Tengyueh, April 24, 1917, collected by R. C. Andrews and Edmund Heller; and four specimens from Fukien collected by H. R. Caldwell, No. 8081, mountains near Yenping, August 1920, 18449, Yenping, April 24, 1921, and 18479–18480, Fukien Province.

There are decided differences between the Fukien and Yunnan specimens at hand. The former have a finely granulate dorsal skin, and much more distinct dorsal spots. The Tengyueh specimens are nearly smooth above, with low rounded warts, and much more distinct lateral warts. The variation in the size of the tympanum in the Fukien specimens indicates that *R. schmackeri* must either be united with *andersonii* or applied to its representatives in eastern China.

***Rana ricketti* Boulenger**

Twenty specimens of this striking species were collected by H. R. Caldwell in Fukien. A. M. N. H. No. 8080 is from the mountains near Yenping, August 1920, while the remaining series, doubtless also from the Yenping area, is labeled simply Fukien Province.

The males are without evident vocal sacs. They have the lower joint of the first finger much enlarged, covered with evenly distributed round tubercles which are not at all horny.

The measurements of two specimens are as follows.

| A. M. N. H. No. | 18567 | 18568 |
|---------------------------------------|--------|--------|
| Sex | ♂ | ♀ |
| Snout to Vent | 56 mm. | 61 mm. |
| Snout to Posterior Border of Tympanum | 18 | 19 |
| Width of head | 19 | 20 |
| Tympanum | 2 | 2.5 |
| Arm | 35 | 36 |
| Leg | 91 | 95 |
| Tibia | 31 | 33 |

***Polypedates exiguus* (Bœttger)**

Two specimens, A. M. N. H. Nos. 670, Pinghsiang, Kiangsi, and 13192, foothills across Siang River, Changsha, Hunan, November 25, 1918, J. W. Williams.

This form was based on a juvenile specimen, and I am by no means sure of the identification of the present specimens with it. No. 13192 has the skin of the back nearly smooth; coloration very like that of *dennysii* but with a row of well-defined white spots along the sides; web between the outer fingers from the bases of the last phalanges, a little shorter between the inner fingers; toes webbed to the discs, but more deeply incised than in *dennysii*, the fourth toe having only a narrow margin of web on the last phalanx; prepollex strongly developed; a pectoral area between the shoulders smooth. No. 670 agrees closely

with the Changsha specimen in coloration and extent of webbing, but has a much more rugose skin on the back and head. It was identified as *dennysii* by Wolsterstorff, but it appears to be amply distinct from that species.

***Polypedates dennysii* (Blanford)**

Three specimens, A. M. N. H. Nos. 5416, Yuchi, Fukien, May 28, 1916, R. C. Andrews and Edmund Heller; 18445, Yenping, Fukien, September 26, 1921, H. R. Caldwell, and 18566, Fukien Province, H. R. Caldwell.

This large species is well characterized by the fully webbed toes and fingers. The disc of the third finger is wider than the diameter of the tympanum.

All three specimens are marked above (on a purple ground color) with dark brown spots, each of which is bordered by a ring of light brown. The distribution of these spots suggests that they are due to shot marks, but no lesion is discernible.

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PLATE XXXI

- Fig. 1. *Rana nigromaculata reinhardtii* (Peters), Ningkwo, Anhwei.
Fig. 2. *Rana nigromaculata nigromaculata* (Hallowell), Tsinan, Shantung.
Fig. 3. *Rana nigromaculata mongolia* Schmidt, Mai Tai Chao, Shansi.



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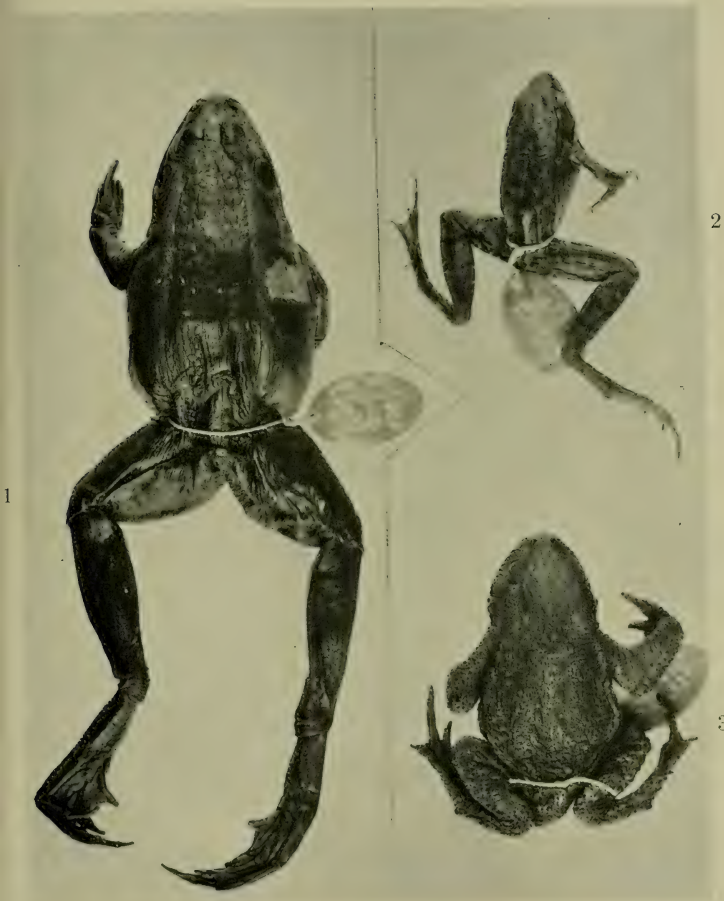
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PLATE XXXII

- Fig. 1. *Rana noblei* Schmidt, type.
Fig. 2. *Rana caldwelli* Schmidt, type.
Fig. 3. *Bufo andrewsi* Schmidt, type.



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PORCUPINES FROM CHINA¹

BY GLOVER M. ALLEN

The Asiatic Expeditions under the direction of Dr. Roy Chapman Andrews have succeeded in assembling a splendid series of no less than forty porcupines from China, mammals which, on account of their size and the difficulty of capturing and preserving them, are likely to be neglected by collectors. Particular credit is due Mr. Clifford H. Pope who secured the greater part of the specimens. Two genera are represented, the brush-tailed porcupine, *Atherurus*, and the more specialized crested porcupine, currently referred to *Acanthion* although regarded by some as inseparable from *Hystrix*. Both genera are found in China in only the southern half of the country. Mr. Pope's series from the island of Hainan contains eleven old and young of *Acanthion* which prove to constitute a very distinct island form allied to that of the Chinese mainland.

Atherurus macrourus stevensi Thomas

Atherurus stevensi THOMAS, 1925, Proc. Zool. Soc. London, p. 505.

A single male skin without skull from Wanh sien, eastern Szechwan, is apparently a considerable extension northward of the recorded range of the brush-tailed porcupine in China. It agrees with *A. stevensi* Thomas, lately described from Tonkin, in the possession of numerous white woolly hairs among the bases of the spines, particularly noticeable over the shoulders. In typical *A. macrourus* from Malacca these are said to be few and brownish. For the present this Chinese form may therefore be considered the same as that from the extreme southern edge of the country, and is probably best regarded as a northern subspecies of typical *macrourus* of Malacca and the Malay Peninsula.

Atherurus macrourus hainanus J. A. Allen

Atherurus hainanus J. A. ALLEN, 1906, Bull. Amer. Mus. Nat. Hist., XXII, p. 470.

A series of seventeen skins, including a very small young one (April 13), was secured by Mr. Clifford Pope near Nodoa, Hainan, through a

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 78.

native hunter. These are very uniform in color, with the spines of the upper surfaces brown, becoming blackish on the back, intermixed with a few long white bristles over the rump. The sides are varied with whitish, each spine with a white tip and base, and brownish central ring. The lower side is soiled whitish. The small size as compared with typical *A. macrourus* is the chief characteristic difference.

***Acanthion subcristatus subcristatus* (Swinhoe)**

Hystrix subcristata SWINHOO, 1870, Proc. Zool. Soc. London, p. 638.

The common porcupine of China and its near relatives differ externally from the crested porcupine of Europe and Africa in the less development of the long erectile dorsal bristles which in the former are confined to a short space on the median part of the neck, with shorter bristles between these and the area of long spikes on the back, whereas in the latter they form a continuous crest from between the eyes to the shoulders. In the skull these eastern members differ in the much less expansion of the nasal cavity, which in typical *Hystrix* is enormously inflated, with the nasals greatly broadened and extended posteriorly so as to encroach upon the frontals. Miller in 1912 ('Mamm. Western Europe,' p. 543) restricted the name *Hystrix* to the European and African species of this type, but more recently Lönnerberg (1923, Arkiv f. Zool., XV, No. 18) has advocated that all the short-tailed porcupines be referred to this genus. He recognizes, however, that they may be divided into three groups, according to the method by which the bones surrounding the nasal chamber are modified in its enlargement; but until a comparative study of all the eastern species can be made, it seems permissible to retain the genus *Acanthion* for the Asiatic species with less modified skulls. In young specimens of the Chinese *Acanthion* a striking feature of the skull is the very large size of the interparietal which is pentagonal and with an area as great as the dorsal part of a parietal in a skull 55 mm. long. In an immature *Hystrix galeata* it is a very small triangular bone.

Swinhoe mentions having often heard of the porcupine at Swatow (Kwangtung Province) and at Foochow (Fukien Province), whence he secured a specimen that later became the type of his *Hystrix subcristata*. Lönnerberg records specimens from Anhwei Province, while the Asiatic Expeditions, in addition to a series from Futsing, Fukien Province, obtained one at Wanhsien, eastern Szechwan, that is similar, and another from Lichiang, Yunnan Province. The last may eventually prove to represent *yunnanensis* Anderson, but the skull is missing. Thomas has shown (Journ. Bombay Nat. Hist. Soc., XXVIII, p. 432) that this name

is valid and applies to a porcupine with short nasals, perhaps representing a species distinct from *A. subcristatus* and closely related to *A. javanicus* of Java, in which the nasals are likewise short. That this type of porcupine was formerly more widespread in China is proved by the discovery of a fossil skull with similar short nasals in Honan Province. This has been named *Hystrix (Acanthion) lagrelii* by Lönnberg (1924, *Palæontologia Sinica*, Ser. C, I, fasc. 3). Although the geologic age of the specimen is not known, its state of preservation suggests that it is not very ancient.

In his list of the mammals of the island of Hainan, Swinhoe (1870, *Proc. Zool. Soc. London*, p. 233) further records the finding of a single porcupine quill "in the jungle at Nychow (S. Hainan)," thus establishing the occurrence of *Acanthion* on that island, but it has remained for Mr. Clifford H. Pope of the Third Asiatic Expedition to secure a fine series of skins and skulls from near Nodoo, which on comparison with the series obtained by the same collector in Fukien, are found to represent a well-marked race, here described.

***Acanthion subcristatus papæ*, new subspecies**

Hystrix hodgsoni SWINHOE, 1870, *Proc. Zool. Soc. London*, p. 233 (not of Gray).

Hystrix subcristata SWINHOE, 1870, *Proc. Zool. Soc. London*, p. 638.

TYPE.—Adult male, skin and skull, No. 60048, American Museum of Natural History, from Nodoo, island of Hainan, China. January 9, 1923. Clifford H. Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Similar to *A. subcristatus subcristatus* but smaller, with a lower and slenderer skull; the nuchal crest is slightly less developed, and the large spines on the back are more extensively dark with correspondingly shorter white tips.

The general color, as in the typical form, is dark blackish brown, with a white half collar or V-shaped mark on the throat formed by short white spines, and a short crest on the mid-line of the neck consisting of elongated slender bristles most of which are deep brown at the base and white on the distal two-thirds. This crest in a series of nine adults is of much shorter and darker bristles than in the Fukien series and in a few is almost altogether wanting. The elongated slender bristles of the lower back are in both forms white except at the extreme base, but the heavier spines have the dark middle portion more extensive so that the white tips are correspondingly much shorter (35 mm. against 50 on the average for the medium-length spines) and there is an almost total lack of long heavy spines that are white throughout. The tail with spines and capsular bristles is similar in both forms but the spines are darker in the Hainan porcupine.

SKULL.—The cranium is smaller and slightly more slender throughout than in typical *A. subcristatus*, with conspicuously less vertical depth. The dorsal profile is very evenly convex and there is no trace of a postorbital process. The nasals are long, pointed anteriorly, and at first relatively narrow, expanding laterally in their terminal (posterior) third. Their combined posterior border is convex backward, its median

point reaching the level of the middle of the orbito-temporal fossa. The median and lateral boundaries of the nasals first disappear through fusion with adjacent bones. The ascending branch of the intermaxillary is narrow, tapering dorsally and with a truncate posterior border. The median length of the combined interparietal and parietals equals or very slightly exceeds that of the frontals. The cheek teeth except for their less transverse width do not differ from those of the mainland animal.

MEASUREMENTS.—The flat skin of the type which is fully adult measures about 670 mm. from snout to end of capsular bristles of the tail; the latter is about 100 mm. long.

The skull measurements follow, with those of No. 60174, adult male, from Futsing, Fukien Province, in parenthesis after each. Greatest length, 135 (138+) mm.; basal length, 121.5 (120); palatal length, 72 (79); diastema, 33 (38); median length of nasals, 74.5 (79); zygomatic width, 65 (74.5); mastoid width, 46 (52); across outer edges of palate, 28 (29.5); upper cheek teeth, 30 (29); lower cheek teeth, 29 (29); mandible from condyle to anterior point of jaw, 85 (91); depth of cranium above *m*¹, 57 (67).

The adults all agree in their small size and dark color as compared with Fukien specimens. The young ones, 165 and 190 mm. in length respectively, were both secured December 9, 1922. They are uniformly dark brown, except for a few long white quills and heavier white-tipped spines on the lower back, and a tuft of white hair at the anal region. There is no trace of white bristles on the nape nor are the bristles here elongated to form a crest.

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A NEW POPLAR (*POPULUS PILOSA*) FROM THE EASTERN ALTAI MOUNTAINS¹

BY ALFRED REHDER

WITH SUPPLEMENTAL NOTES ON THE DISTRIBUTION AND HABITAT

By R. W. Chaney

Populus pilosa Rehder, sp. nov.

A tree 5-12 m. high; trunk 30-75 cm. in diameter (according to R. W. Chaney); bark deeply fissured, whitish-gray; branchlets (only brachyblasts seen) thick, roughened by closely crowded scars with almost no internodes, densely pilose, glabrescent about the third year, yellowish white, the older marked with rather small blackish lenticels otherwise smooth, yellowish white; buds viscid, pubescent on the outside. Leaves ovate or broadly ovate, 4.5-8 cm. long and 4-6 cm. wide, short-acuminate, more rarely longer acuminate, subcordate at base, or truncate or rounded, slightly crenate, with minutely or indistinctly mucronulate teeth (3-5 to 1 cm.) hairy above on the slightly or scarcely raised midrib and pilose on the veins, more sparsely and finely on the veinlets and the whole surface, paler beneath, white or yellowish white, loosely pilose on the midrib toward the base, moderately densely so on the veins, otherwise glabrous or nearly glabrous; petioles subterete, 1-2.5 cm. long, densely yellowish, pilose. Fruit-bearing aments subsessile, 5-8 cm. long, dense; rachis pilose; bracts wider than long, fimbriate-laciniate and glabrous; capsules sessile, globose-ovoid, with pubescent, subcrenate disc 4-5 mm. in diameter; valves round-ovate, 4.5 long and 3.5 wide, abruptly short-acuminate at apex, pubescent on the outside.

Mongolia: Baga Bogdo, Altai Mts., stream valley and terraces, alt. 1600-2300 m., R. W. Chaney, no. 215, in 1925 (Third Asiatic Expedition Amer. Mus. Nat. Hist.).

Populus pilosa Rehder, sp. nov.

Arbor 5-12 m. alta, trunco 30-75 cm. diam. (fide R. W. Chaney), cortice profunde fisso albedo-cinereo; ramuli (brachyblasti tantum adsunt) crassi, cicatricibus arete congestis asperati internodiis fere nullis, dense pilosi, circiter tertio anno glabrescentes, ochroleuci, vetustiores lenticellis nigrescentibus satis parvis notati ceterum leves, ochroleuci; perulae viscosae, extus pubescentes. Folia ovata vel late ovata, 4.5-8 cm. longa et 4-6 cm. lata, breviter acuminate, rarius longius acuminate, basi subcordata vel truncata vel rotundata, leviter crenata dentibus minute vel obsolete mucronulatis (3-5 ad 1 cm.) ciliata, supra in costa leviter vel vix elevata et in nervis

¹Publication of the Asiatic Expeditions of the American Museum of Natural History. Contribution No. 900



Fig. 1. Photograph of an herbarium specimen showing leaf, bark, and flower of *Populus pilosa*.

pilosa, sparsius et minutius in venulis et facie, subtus pallidiora, albida vel flavido-albida, in costa basin versus satis dense in nervis laxius pilosa, in facie glabra vel fere glabra; petioli subteretes, 1-2.5 cm. longi, dense flavido-pilosi. Amenta fructifera subsessilia 5-8 cm. longa, densa; rhachis pilosa; bractee latiores quam longae, fimbriato-laciniatae, glabrae, capsulae sessiles, globoso-voideae, disco pubescente subcrenato 4-5 min. diam., valvis rotundato-ovatis, 4.5 longae et 3.5 latae, apice breviter subito acuminulatis extus pubescentibus.—Affinis videtur *Populo Przewalskii* Maxim. a qua differt praecipue ramulis gemmisque pilosis, petiolis brevioribus dense pilosis vel hirsutis, foliis utrinque ad costam venasque pilosis, et capsulis minoribus.

Mongolia: Baga Bogodo, Altai Mts., stream valley and terraces, alt. 1600-2300 m., R. W. Chaney, no. 215, in 1925 (Third As. Exped. Am. Mus. Nat. Hist.).

This new species belongs in the section *Tacamahaca* and seems most closely related to *P. Przewalskii* Maxim. (*P. suaveoleus* var. *Przewalskii* Schneid.) from which it differs in the pilose branchlets and winter-buds, the densely pilose or hirsute shorter petioles and in the leaves being pilose on midrib and veins on both surfaces; the small subglobose capsules are also a prominent character. It may possibly turn out to be an extreme strongly pubescent form of *P. Przewalskii*, but as I have seen no material of that species, I prefer to consider this Mongolian Poplar a distinct species.

NOTES ON THE DISTRIBUTION AND HABITAT OF *POPULUS PILOSA* IN MONGOLIA

By R. W. Chaney

The scarcity of trees in the Gobi desert region is striking evidence of the low rainfall over this great plateau. Elms, *Ulmus pumila*, are numerous on the grasslands bordering the Gobi to the south, but have been noted in only a few cases extending northward for a short distance into the desert proper. A single willow tree, *Salix viminalis* var. *splendens*, was seen in one of the valleys at Ondai Sair. But apart from these, no trees have been noted on the Mongolia Plateau¹ outside of the canyons of the Altai Mountains, a range which extends in a southeasterly direction across the western side of the Gobi desert.

The comparative abundance of trees in the canyons of the Altai Mountains is the result of the greater precipitation there, and the higher degree of protection from evaporation by the winds which are so characteristic of the Gobi proper. Not only are trees more abundant, but plants of all sorts are more numerous and, as observed during the summer of 1925, continue in a green state long after the vegetation of the adjacent

¹The Arctic Divide to the north, with its comparatively rich forest, is considered to be geographically distinct from the Gobi.

lower country has become dry. We experienced rain on three of the six days spent on Baga Bogdo during the latter part of June, and there was a considerable fall of snow on the peak on June 20th; a month later at Artsa Bogdo there were showers on four of the five days we spent in the mountains. Several of the higher peaks, such as Baga Bogdo and Ikhe Bogdo, have snow on their tops and protected slopes during most or all of the year. This was the case in 1925, and there was ample evidence to indicate that snow had persisted for at least two years in some of the larger canyons. As a result there are permanent streams in these canyons, along which conditions for plant growth are in striking contrast to those of the arid open slopes beyond the canyon mouths. None of the streams were observed to flow beyond the mouths of their canyons before they disappeared by evaporation and by sinking into the coarse gravel and sand of the fans. It was in these canyons and in the upper portions of the fans below their mouths that *Populus pilosa* was collected and observed on Baga Bogdo and Ikhe Bogdo. None were seen on Artsa Bogdo and Gurban Saikhan, the easternmost mountains of the Altai which extend farther out into the Gobi and may be supposed to present less favorable conditions for tree growth. The occurrence in one of the larger canyons on the north side of Baga Bogdo, called Tiger Canyon by members of the Expedition, will here be described as typical of the several similar occurrences on this mountain and on Ikhe Bogdo to the west.

Tiger Canyon in its lower portion is cut into a coarse alluvial deposit, the walls rising steeply some 400 feet to an upper terrace; its width is 2000 feet at the top and a few hundred feet at the bottom. A quarter of a mile above the mouth the canyon is cut into granite and is greatly narrowed with much higher walls. A mile and a half above the mouth metamorphic rocks form a still narrower canyon. The floor is littered with coarse gravel and with boulders up to 20 feet in diameter, and there are numerous terraces which give it an irregular surface. The stream was at most only a few feet in width and less than a foot deep, as observed in June, 1925. It has a high gradient, and the water is clear and cold. Extending for several miles down the side of the mountain below the mouth of the canyon is a broad alluvial fan, cut by numerous dry channels, and littered with gravel and coarse boulders. The stream disappears into the gravel more than a quarter of a mile above the canyon mouth, but its presence in the gravels under the surface of the fan may be inferred from the distribution of trees for more than a mile down the steep slope of the fan below the mouth of the canyon. These trees, all of

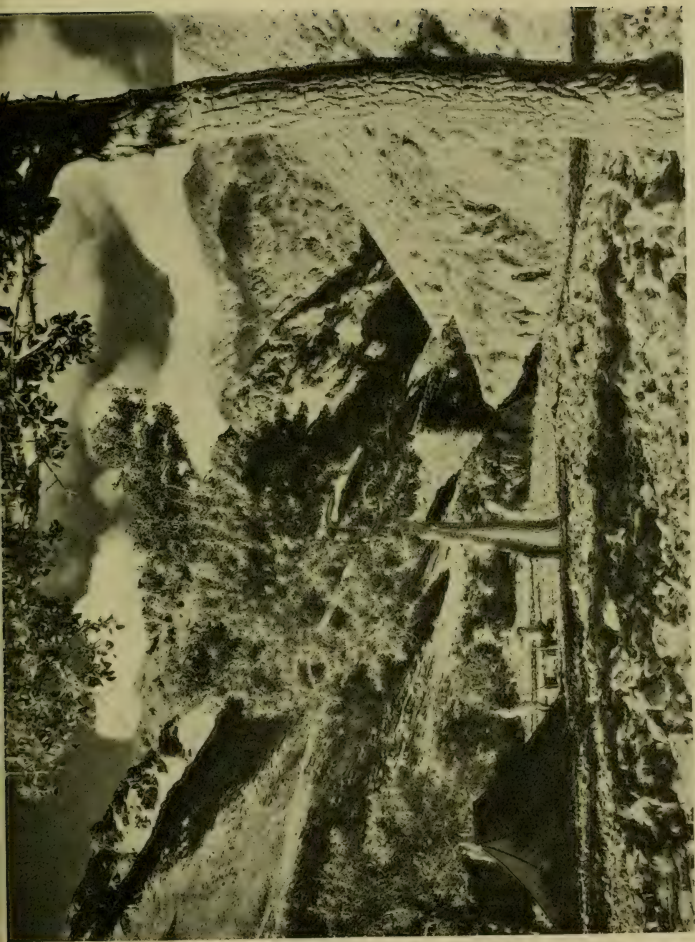


Fig. 2. View of Tiger Canyon showing *Populus pilosa* growing in the steep-sided granite valley.

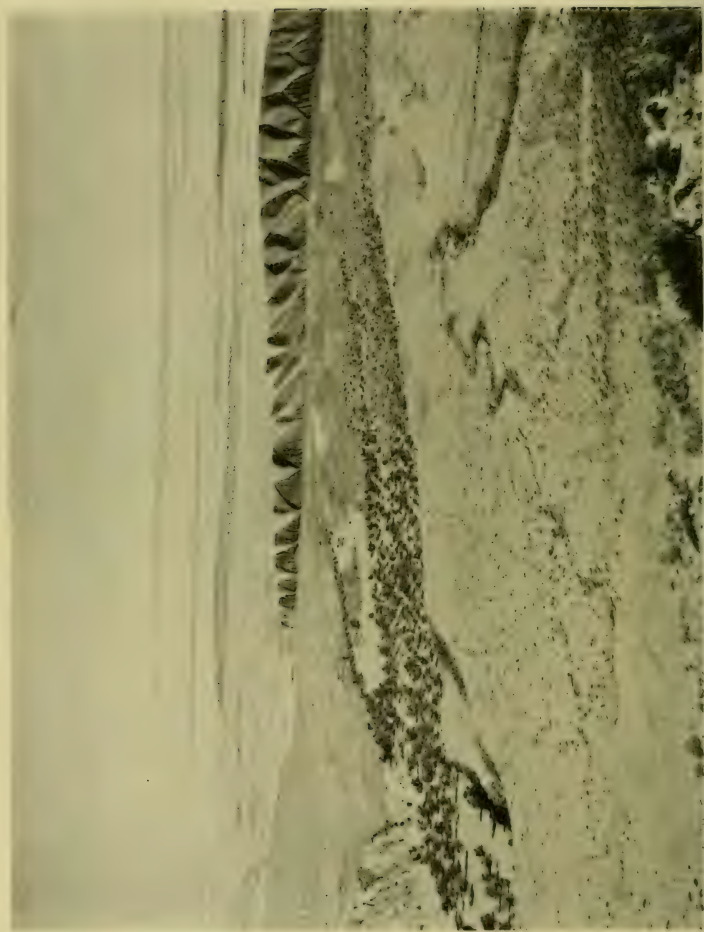


Fig. 3. View northward from Tiger Canyon showing the alluvial fan with scattered trees of *Populus pilosa*.

which are cottonwoods, *Populus pilosa*, are from 15 to 25 feet in height and from 8 to 18 inches in diameter. At the lower end of their distribution (elevation 5200 feet) many are dead, indicating that the supply of water there is inadequate. Except for the trees the fan is essentially bare of vegetation, but along its borders a species of *Artemisia*, as yet undetermined, is abundant together with several species of grass and legumes, and low bushes of *Prunus mongolica*.

In the canyon the trees are more numerous and larger, reaching a maximum height of about 40 feet and a diameter of up to 30 inches. Here the added protection of the canyon walls permits a more symmetrical growth of the trees. They are found along the stream for a distance of at least two miles up the canyon to an elevation of about 7500 feet where it becomes too rocky and narrow for them to gain a footing. Since most of the specific determinations of the flora have not yet been made, a complete and exact list of the associated plants cannot here be given, but it includes *Salix phylicifolia* which reaches the dimensions of a small tree, *S. glauca*, *Cotoneaster melanocarpa*, *Lonicera microphylla*, and *Spiraea chamædryfolia* among the woody plants, the fern *Cystopteris fragilis*, and numerous herbs of which the Leguminosæ and Ranunculaceæ are well represented. No seedlings of *Populus pilosa* were observed in Tiger Canyon or on its fan, but there were a few in the next large canyon to the west where there is also a permanent stream. While trees here are numerous, few of them reach the size of those in Tiger Canyon, the average diameter being little more than 8 inches. No exact count of the trees was made, but it may be conservatively estimated at several hundred in each of these two canyons. In the only large canyon observed at Ikhe Bogdo, the next large range west of Baga Bogdo, the trees were not as numerous and did not extend as far down the fan.

The use of the wood of *Populus pilosa* by the Mongols is abundantly indicated by sawed stumps in Tiger Canyon. Portions of the logs are hollowed out and made into tea mortars and water containers. The Mongol name for this tree, *Toré* meaning hollow, is indicative of this utilization of it by a people whose nearest approach to contact with forests is in the scattered groves of the Altai canyons.

In addition to *Populus pilosa* and two species of *Salix*, which were the only trees seen by the writer in the Gobi region proper, an arborescent species of *Betula* was seen by Charles P. Berkey in a large canyon on Ikhe Bogdo. It is significant to note that all three of these genera, as well as *Ulmus* of the grasslands and Gobi border of the south, have wind-borne seeds, a fact which is probably responsible in large part for their

distribution in the more suitable areas of the arid plateau of Mongolia. The source of the seeds which first established the trees of the Altai canyons may be supposed to be the higher and moister continuation of the range to the west. An alternative explanation may be that these patches of trees represent relict areas of a forest which was once more widespread and probably continuous with that farther west along the Altai Mountains. The finding by Nels C. Nelson of birch-bark utensils in a prehistoric burial north of Ikhe Bogdo is evidence, in any case, of the presence of *Betula* in the region for several hundred years.

No data are available as to the age of the trees of *Populus pilosa*, but in view of their probable slow growth it may be supposed to reach several scores of years in the case of the larger individuals. Bearing on this problem is the situation of several of the trees near the head of the fan at Tiger Canyon. The basal 8 or 10 feet of their trunks has been buried by gravel deposits, which may be interpreted as indicating a fluctuation of rainfall and therefore of deposition during the period in which they have been living.

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NEW ASIATIC MAMMALS¹

BY GLOVER M. ALLEN

In the course of identifying the small mammals collected by the Asiatic Expeditions of The American Museum of Natural History in recent years, the following new forms have been found, which seem worthy of description.

Soricidæ

Crocidura lar, new species

TYPE.—Male, skin only, No. 59940, American Museum of Natural History, from Tsagan Nor, Mongolia. August 3, 1922. Third Asiatic Expedition.

DESCRIPTION.—A very small, pale species, with relatively short tail.

Upper surface of body and tail a very pale grayish brown, about "wood brown" of Ridgway (1912), the hairs dark slaty at their bases, then minutely ringed with gray, and tipped with pale brown. The gray rings showing through give a minutely grizzled effect and heighten the pallor of the upper side. Under surface of snout and tail, the entire chin and the backs of fore and hind feet white to the roots of the hairs. The rest of the under side of the body has the hairs slaty gray at the base tipped with white, so that the entire belly looks dull white. The tail is well clothed with short hair forming a small pencil, and is rather sharply bicolor; it has the numerous scattered bristles projecting conspicuously throughout its length.

SKULL.—Unfortunately the skull cannot now be found.

MEASUREMENTS.—The collector's measurements are: head and body, 60 mm.; tail, 29; hind foot, 12; ear, 8.

The discovery of a species of this genus in the Gobi Desert far beyond its previously known northward range in this part of Asia is very interesting. That the species is rare there is evident from the fact that with much trapping no other specimens were secured. This individual was caught in one of the tents into which it came one night. Although the skull is not available for study, the species seems so distinct in its pale desert coloration, small size, and short tail, scarcely twice the length of the hind foot, that I have no hesitation in naming it.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 80.

Rhinolophidæ***Rhinolophus blythi parvus*, new subspecies**

TYPE.—Adult, skin and skull, No. 58465, American Museum of Natural History, from Nodda, island of Hainan, China. December 8, 1922. Clifford H. Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Structurally like *R. b. szechuanus* of western China and *R. b. calidus* of southeastern China, but differing from both in its rich russet or darker brown coloring.

Color above in the red phase, nearly "russet" (Ridgway). The individual hairs over the back are pale ochraceous at their bases, deepening to a distinct russet tip about 2 mm. in length. Scattered among these are hairs with minute blackish tips, producing a darkening of the surface. On the sides of the head and on the neck, chest and mid-ventral area, the color is clearer, brighter russet; the throat is paler, pinkish buff. In the axillar area, ventrally, is a well-defined dusky area. Specimens in the brown phase are Mars brown, paling to the roots of the hairs, above; below, drab washed with chestnut at the sides.

SKULL.—The cochleæ are very large, nearly meeting in the midline so that the basioccipital is very much narrowed. There is a well-defined sagittal crest, branching anteriorly to form a ridge over each orbit, with a slight depression between. The first small upper premolar stands quite in the tooth row; while in the lower jaw the minute middle premolar of the type specimen stands in the row, but in other specimens may be partly external to it.

MEASUREMENTS.—In the type the forearm measures 36.3 mm.; third metacarpal, 27; fourth metacarpal, 28; fifth metacarpal, 27.6; tibia, 13.5; foot, 7.

The skull measures: greatest length, 16.5; basal length, 13.3; palatal length, 5.4; palatal bridge, 1.7; zygomatic width, 7.5; mastoid width, 7.7; width outside molars, 5.7; upper cheek teeth (canine to last molar), 5.7; lower cheek teeth (canine to last molar), 6.0.

Among the specimens secured, a bright, tawny phase is the more common, while a deep-brownish phase is also represented. In its brighter, more intense coloring it forms a marked contrast to the dull, gray-colored *R. b. szechuanus* in which the bases of the dorsal hairs are whitish, their tips drab, the belly drab. In *R. b. calidus* of eastern China the color becomes slightly more buffy but in this race from Hainan it is strikingly redder, even to the bases of the hairs. A series of over fifteen skins collected by Mr. Clifford H. Pope shows much uniformity of tint; but the dull-colored, grayish immature specimens are about as bright as adults of *R. b. calidus*.

In the dark or brownish phase this race resembles the two others mentioned, but is a much darker brown. The immature individuals of the series are similar, and it is possible that these brown adults are in reality not fully mature.

***Rhinolophus lanosus spurcus*, new subspecies**

TYPE.—Adult male, skin and skull, No. 58444, American Museum of Natural History, from Nodoa, island of Hainan, China. December 4, 1922. Clifford H. Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—A large, woolly-haired species with the external proportions as in typical *R. lanosus* of Fukien, China, but the skull much larger and the fur more sooty brown.

Andersen described *R. lanosus* as a member of the *philippinensis* group, with the base of the central nose-leaf forming wing-like lateral expansions. The fur is long and woolly, somewhat wavy, of a dull chocolate-brown above and below, tipped minutely with gray, giving a slightly frosted effect. In *R. lanosus* from Fukien, the color is a slightly richer brown.

SKULL.—The skull is decidedly larger than that of *R. lanosus*. The supraorbital ridges in both meet to form a prominent sagittal crest and cut off anteriorly a triangular depression between the orbits. The parietal area shows a curious pitting of the surface of the bone. The upper small premolar is quite in the tooth row but the lower one is partly external, so that it separates the two larger premolars, whereas in the Fukien race it is smaller and more to the exterior, allowing the two large premolars to meet.

MEASUREMENTS.—No collector's measurements accompany the specimens. The forearm measures 70 and 71 mm. in the type and a second male respectively. Third metacarpal of type, 44.7 mm.; fourth metacarpal, 53.2; fifth metacarpal, 54.2; tibia, 36; foot, 18.

The skull measurements of the type follow and, in parenthesis after each, those of an adult male from Fukien: greatest length, occiput to front of canine, 31.3 (28.4); foramen magnum to front of canine, 25.2 (23.0); palatal notch to front of canine, 9.6 (9.2); zygomatic width, 15.5 (13.2); mastoid width, 13.5 (12.8); width across molars, 10.4 (10.3); palatal bridge, 5.0 (4.8); upper cheek teeth, 11.3 (10.7); lower cheek teeth, canine to back of last molar, 12.0 (11.1); mandible from condyle to base of incisors, 21.5 (20.0).

This large woolly-haired species was originally described from Fukien Province, China, whence a small series was later obtained by Dr. Roy Chapman Andrews and Rev. H. R. Caldwell. The skull measurements of the type of *R. lanosus* agree almost exactly with those of a male from Yenping, Fukien, and are thus considerably smaller than those of the Hainan specimens, although the external dimensions are practically the same. Mr. Clifford H. Pope, who secured these bats, writes that they are rare. The first one was found in a prospector's shaft in woods. This tunnel was about fifteen feet deep, slanting, and not completely dark. A second bat was started but not secured in another similar shaft. A third was taken in another tunnel in woods. In each case the solitary bat was the only inhabitant of the cave and hung from roots in the ceiling.

Hipposideridæ***Cœlops sinicus*, new species**

TYPE.—Adult female, skin No. 84893, and skull No. 84388, American Museum of Natural History, from a cave two miles northeast of Wanh sien, Szechwan, China, February 26, 1926. Collected by Walter Granger; Third Asiatic Expedition.

DESCRIPTION.—Related to *Cœlops frithii* Blyth but smaller with a different coloring, and without a space between lower outer incisor and canine.

The pelage is long, dense and woolly, about 11 mm. in length on the back. The hairs, instead of being "shining brown" above and below, with pale bases, as described in *C. frithii* from Bengal, are blackish for the proximal two-thirds, with the terminal third indistinctly brown, nearly "sepia" of Ridgway (1912). The lower surfaces are similarly blackish at the bases of the hairs, then minutely brownish, tipped with gray, producing an indistinctly tricolor effect on close inspection. The membranes and the large translucent ears are smoke-gray.

In the structure of its remarkable nose-leaves, the specimen agrees closely with *C. frithii* as figured by Dobson. The horseshoe and the median erect process posterior to the nostrils are thickly clothed with short stiff hairs, while longer hairs arising from the sides of the nose-leaves behind the horseshoe form a well-defined fringe. On each side are six longer, shining hairs, probably sensory, one from back of the anterior edge of the main leaf of the horseshoe, three along its lateral edge, and two erect hairs from the face of the raised ridge behind the nostrils.

The wing in this genus is peculiar in the shortness of the third finger and the length of the fifth. The thumb has a very long metacarpal and short phalanx (7: 1.6 mm.), the former wholly involved in the propatagium; the second digit has no phalanges, and its metacarpal is minutely longer than the combined metacarpal and first phalanx of the third digit. The latter is the longest digit due to the great length of its second phalanx, for its metacarpal and first phalanx are less than those of the fourth or the fifth digits. The fourth finger is shorter than the third or fifth. The wing membrane arises from the metatarsus at the base of the toes. The calcaneum is well developed, as long as the toes, and serves to spread the interfemoral membrane which is deeply emarginate to within about 6 mm. of the body in the dried skin, and has its free border thinly fringed with short hairs.

SKULL.—The skull, compared with that of *Hipposideros gentilis*, is remarkable for its delicate structure, with a nearly globular brain-case and very narrow inter-orbital constriction, to which the sharp sagittal crest is confined. The frontal shield is nearly flat, its dorsal surface inclined at a sharp angle to the plane of the tooth row, and its anterior swellings but little raised above the general level on each side. The peculiar prolongation of the premaxillæ and maxillæ combine to give the skull a profile that tapers nearly to a point in front.

The upper canine is noticeably compressed, with a prominent secondary cusp, projecting about half-way on the posterior cutting edge. The anterior small upper premolar is distinctly crowded to the outer side of the tooth row, but the second premolar does not quite reach the base of the canine. In the lower jaw the outer incisor abuts closely against the canine instead of being separated by a space as in *C. frithii*, and in height barely exceeds the cingulum of the canine. The anterior lower premolar is slightly to the outer side of the tooth row. All the lower cheek teeth are much compressed and blade-like.

MEASUREMENTS.—The collector's measurements are: head and body, about 38 mm.; ear, 16; spread of wings, 232. The forearm measures 35.5 mm.; thumb, metacarpal, 7; phalanx, 1.6; second finger, metacarpal, 35 (the bone is slightly bowed in the skin); third finger, metacarpal, 26.3; first phalanx, 7; second phalanx (across the chord of the bone as bent in drying), 22; fourth finger, metacarpal, 28.6; first phalanx, 9.0; second phalanx, 10.2; fifth finger, metacarpal, 30.5; first phalanx, 10.1; second phalanx, 12.0; tibia, 16.4; hind foot, 8; calcar, 5.

Skull: greatest length, 17.0; basal length, 13.5; condyle to front of canine, 15.1; palatal length, 6.2; median length of premaxillaries, 4.0; zygomatic width, 7.8; mastoid width, 8.2; interorbital constriction, 1.8; width of frontal shield, 3.9; width outside molars, 5.8; front of canine to back of last upper molar, 6.4; lower tooth row, incisor to back of last molar, 6.8.

Of this rare genus there is at present recognized but two species, *Cælops frithii*, of Bengal and Java and *C. robinsoni* of Pahang, a slightly smaller replica of it. The single individual on which the new species is based extends the known range of the genus well into China. While its relationship to the Indian species may eventually prove to be closer than indicated, its smaller size and different style of coloring seem to proclaim its specific distinctness. The highly modified upper canines with their strong forward projection, prominent secondary cusp, and compressed cutting edge, the deeply emarginate tail membrane, the peculiar nose-leaves and enlarged ears may indicate some unusual feeding habit. In contrast to its relatives *Hipposideros*, *Cælops* seems to be solitary in habits. The specimen described was secured by Mr. Walter Granger from a "warm-air" cave, in which it was evidently hibernating.

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SEVEN NEW REPTILES FROM FUKIEN PROVINCE, CHINA¹

CLIFFORD H. POPE

In this paper I describe six new snakes and a new lizard collected by myself in Fukien Province for the Third Asiatic Expedition of The American Museum of Natural History during 1925 and 1926. The American Museum's earlier reptile collections from China were reported by Karl P. Schmidt in 1927. A report on all the more recently collected Chinese reptiles, now in manuscript form, will appear shortly, bringing the matter up to date.

Kuatun, from where many species have been described, is a village in the mountains of Ch'ungan Hsien, the type locality for all but one of the new species described herein.

SAURIA

Lacertidæ

Apeltonotus sylvaticus, new species

TYPE.—A. M. N. H. No. 34975; ♀; Ch'ungan Hsien, northwest Fukien Province, China; April-September, 1926; Clifford H. Pope.

DIAGNOSIS.—This species differs from *dorsalis* in having a less distinct collar, much shorter limbs, more scales across the middle of the back, a greater number of transverse series of ventral plates, and a distinctive color pattern.

DESCRIPTION OF TYPE.—Head twice as long as broad, its length contained $4\frac{1}{2}$ times in total length to vent; snout acutely pointed, a little longer than postocular part of head, with a sharp canthus, and a vertical, slightly concave loreal region. Neck slightly narrower than head. Hind limb stretched forward fails to reach elbow; fore limb stretched backward fails to touch knee; foot slightly longer than head; tail long, slender.

Nasals not in contact behind rostral; rostral and frontonasal forming a short suture; frontonasal longer than broad; frontal as long as its distance from end of snout, narrower behind than in front; parietals about $1\frac{1}{2}$ times as long as broad, outer border convex; interparietal small, slightly longer than frontonasal; occipital very small; 2 large and 2 small supraoculars; supraciliaries 5, separated from supraoculars by a series of granules. Rostral just separated from nostril; a single postnasal; anterior loreal barely half as large as posterior, only third and fourth upper labial in contact with posterior loreal. Four pairs of chin-shields, first pair completely in contact, second barely separated posteriorly.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 81.

Scales on back largest, strongly keeled, those on sides granular, the two types gradually merging, slightly intermixed, 44 scales across middle of body. Ventral plates in 6 longitudinal, 24 transverse rows, plates of outer longitudinal row distinctly keeled and pointed, remainder barely so. Preanal plate large, smooth, bordered by a semicircle of 6 plates as large as those of last transverse row of ventrals; 4 of 6 are anterior, 2 lateral. Three femoral pores on each side; 26 lamellæ under fourth toe. Caudal scales strongly keeled, twice as long as largest dorsals.

Color, dark green above, lighter below, lightest on the throat. A continuous white stripe from subocular to base of hind leg. This line passes just below tympanum, above base of fore limb, and along fourth to sixth lateral rows of scales; vivid on head and neck, distinctly less so on body.

Four paratypes, all from type locality, Nos. 34972-974 and 34976.

SERPENTES

Colubridæ

Pseudoxenodon fukienensis, new species

TYPE.—A. M. N. H. No. 34650; ♂; Ch'ungan Hsien, northwest Fukien Province, China; April-September, 1926; Clifford H. Pope.

DIAGNOSIS.—A small *Pseudoxenodon* without a caudal stripe but with a vivid head and body pattern persistent throughout life. The ventral count is low, the caudal high, and, as might be expected, the tail proportionately long. Lower labials only 8-8.

DESCRIPTION OF TYPE.—Rostral broader than deep, just visible from above; internasals shorter than prefrontals; frontal much longer than broad, as long as its distance from end of snout, slightly shorter than parietals, which are as long as their distance from internasals. Loreal deeper than long; preoculars 1-1; postoculars 3-3; both anterior and posterior temporals 2-2; upper labials 8-8, fourth and fifth entering eye. Four pairs of lower labials in contact with anterior chin-shields. Scale formula 19-17-15, the reduction from 19 to 15 taking place so abruptly at midbody that the section covered by 17 rows is equal only to width of some 20 ventral plates; at midbody all scale rows keeled. Ventrals 138; anal divided; subcaudals 62; total length 616 mm., 0.22 occupied by tail.

Fundamentally, the dorsal color pattern is strikingly like that of the other *Pseudoxenodons*, but actually it is distinct because of the different values of the component parts. The rather faint, middorsal light spots, 36 in number, are black-bordered before and behind, and from side to side cover 3 or 4 scale widths, while longitudinally they cover the length of a scale. The lateral black spots fall opposite the central light ones and are about twice as large. There is a purplish tinge to the ground color along the sides that is lacking down the middle of the back. On the tail only the light spots, 15 in number, predominate, for there the rest of the pattern is obscure.

The ventrum has the usual dark speckling which is almost lacking on the first score of ventral plates just as in the other *Pseudoxenodons* described herein. The speckling is proportionately less concentrated laterally, but the individual spots tend to run together along the base of each plate, and, posteriorly, across the center. The greatest profusion of speckles is reached before the anus, for behind it they are only moderately profuse and almost lacking along the juncture of the divided subcaudal plates.

The top of the head is black except for a gray interocular band and a gray temporal stripe irregular in outline extending from the eye to a little above the angle of the mouth. The side of the head between the eye and nasal opening is also gray, as is the rostral plate. At the sutures between each of the first 5 upper labials is a wedge-shaped, black spot directed downward. A postocular stripe, just below the temporal one described above, borders the sixth and crosses the last 2 upper labials, sending a point downward at the suture between the sixth and seventh. There is a very conspicuous V-shaped, black band across the neck whose apex reaches almost to the parietals.

All of the 14 paratypes are from the type locality. Their numbers are 33749, 34642-649 and 34651-655.

***Pseudoxenodon karlschmidtii*,¹ new species**

TYPE.—A. M. N. H. No. 34658; ♀; Ch'ungan Hsien, northwest Fukien Province, China; April-September, 1926; Clifford H. Pope.

DIAGNOSIS.—A *Pseudoxenodon* allied to *sinensis* from which it differs through a lack of yellow in the dorsal pattern, in having a narrower head, higher labial count, more ventrals in the males, fewer in the females, and fewer subcaudals in both sexes. Moreover, *karlschmidtii* undergoes a more marked color change during ontogeny.

DESCRIPTION OF TYPE.—Rostral broader than deep, just visible from above; internasals much shorter than prefrontals; frontal much longer than broad, barely as long as its distance from end of snout, just as long as parietals, which are much less than twice as broad in front as behind. Loreal deeper than long; preoculars 1-1; postoculars 3-3; anterior temporals 2-2; posterior, 2-3. Upper labials 8-8, fourth and fifth entering orbit; lower labials 9-10; four in contact with anterior chin-shields on one side, 5 on other. Scales reduced from maximum of 19 to minimum of 15 at mid-body, consequently, count of 17 extends along a distance equal to width of only some 6 ventrals. Ventrals 154; anal divided; subcaudals 56; total length 796 mm., 0.18 taken up by tail.

The ground color of the dorsum is blackish gray. Down the middle of the back are 24 light gray spots. From side to side each spot covers the width of 4 to 6 scales, but longitudinally only the length of one. Some of these spots lie obliquely and all are surrounded by scales part black and part gray. Anteriorly on either side is a very indistinct row of darkish spots made up of black-bordered scales. These darkish spots for the most part alternate with the middorsal spots. The majority of the dorsal scales have minute traces of black. The light, middorsal row of spots extends on to the tail where there are 5 distinct and 2 indistinct ones. There the black borders are very indistinct. Beginning about 20 plates from the chin-shields, the ventrals are speckled with black more and more profusely toward the tail under which the speckling is so profuse that the subcaudals appear black. Laterally the speckles are concentrated along the tips of the ventrals to form a line, while in general they are gathered along the bases of the scales. The tips of even the first 20 plates are black.

¹Named for Mr. Karl P. Schmidt who has already reported the former Asiatic collections of the American Museum.

The ventral surface of the head is immaculate. The temporal region is darker than the dorsal surface of the head but there is no distinct postocular band. All but the last 2 upper labials on either side are narrowly bordered with black behind.

There are 6 paratypes (A. M. N. H. Nos. 34638-641 and 34659-660).

***Pseudoxenodon striaticaudatus*, new species**

TYPE.—A. M. N. H. No. 33759; ♀; Ch'ungan Hsien, northwest Fukien Province, China; June-July, 1925; Clifford H. Pope.

DIAGNOSIS.—A *Pseudoxenodon* differing from its ally, *dorsalis*, in having a higher ventral and subcaudal count, and in lacking all traces of yellow or red in its coloration.

DESCRIPTION OF TYPE.—Rostral much broader than deep, just visible from above; internasals slightly shorter than prefrontals; frontal longer than broad, as long as its distance from the rostral, shorter than the parietals which are twice as broad in front as behind. Loreal deeper than long; preoculars 1-1; postoculars 3-3; both anterior and posterior temporals 2-2. Upper labials 8-8, fourth and fifth entering eye; lower labials 9-10, four in contact with anterior chin-shields on one side, 5 on the other. Nineteen rows of scales on neck, 17 from neck to midbody, 15 from middle of body to anus; at midbody all but 3 rows on either side feebly keeled. Ventrals 148; anal divided; subcaudals 55. Total length 776 mm., tail 0.18 of total.

The dorsum is an obscure, intricate mixture of black and gray, blending on the neck to give a uniformly dark appearance but arranged along the midregion to form indistinct, black-bordered, diamond-shaped spots reaching to the second scale row on either side. Most of the scales not entering this pattern are gray, many others are gray but bordered with black, while a few are entirely black. From a point a tail's length anterior to the anus a black-bordered, middorsal, light gray stripe extends to tip of tail. This is the most conspicuous marking on the dorsum. The light ventrum is profusely spotted with black. The spots run together laterally to form a black band and centrally are most numerous along the anterior edge of each plate. The spots are varied in size and shape and hazy in outline. They are present only on the tips of the first few ventrals.

There is a dark line from behind the eye to the angle of the mouth while all but the last 2 upper labials are black-bordered posteriorly. The ventral surface of the head is milky white.

There are 20 paratypes, all from the type locality (Nos. 33760-762, 34596 and 34662-677).

***Dinodon futsingensis*, new species**

TYPE.—A. M. N. H. No. 34106; juvenile ♀; Futsing Hsien, Fukien Province, China; August-October, 1925; Clifford H. Pope.

DIAGNOSIS.—A black and white banded *Dinodon* allied to *ruhstrati*. The scales are smooth, in 17 rows on the neck and at midbody, 15 just before the anus. Ventrals 197; subcaudals 79. Also allied to *yunnanensis* and *septentrionalis*.

DESCRIPTION OF TYPE.—On the anterior extremity of the maxillary there are 4 small, subequal teeth. These are followed immediately by 4 much larger ones, the third of which is the longest. The remaining teeth, about 3 in number, are arranged along the maxillary some distance behind the first 8.

Rostral broader than deep, plainly visible from above; internasals distinctly narrower than the prefrontals and only half as long. Frontal slightly longer than broad, shorter than parietals, as long as its distance from end of snout. Loreal twice as long as deep, not entering eye; preoculars 1-1; postoculars 2-2; anterior temporals 2-2; posterior, 3-3. Upper labials 8-8, the third, fourth and fifth entering the orbit on one side, the fourth, fifth and sixth, on the other; lower labials 10-10, the first 5 in contact with the anterior chin-shields which are a little shorter than the posterior. Anal entire. Total length 227 mm., 0.21 occupied by tail.

The body is black, crossed by 22 white bands which are 2 scale lengths in width on the middle of the back but wider on the sides where they join the faintly clouded, white belly. Nearly all of these bands split just before they reach the ventrals. The 12 white bands on the tail scarcely widen laterally. Except on the neck, where they are much more widely separated, these white bands are 5 to 6 scale-lengths apart. The subcaudals are dark. There is a conspicuous white area extending anteriorly as far as the eyes and posteriorly 3 scale-lengths behind the parietals. Laterally it extends to the next to the last upper labial and finally joins the white of the throat. There are slight traces of black on this area, the most conspicuous being a narrow line from the posterior tip of the parietals to the beginning of the black ground color of the neck.

The single paratype, No. 34105, is also from Futsing Hsien and agrees remarkably well with the type.

***Opisthotropis kuatunensis*, new species**

TYPE.—A. M. N. H. No. 34437; ♀; Ch'ungan Hsien, northwest. Fukien Province, China; April-September, 1926; Clifford H. Pope.

DIAGNOSIS.—An *Opisthotropis* allied through strongly keeled scales and a high upper labial count to *rugosa* and *typica* of Sumatra and Borneo. The nasals are undivided and the prefrontal single.

DESCRIPTION OF TYPE.—Maxillary teeth 25, small, subequal. Head broad, depressed; nostrils near upper edge of the nasals which are not in contact. Internasals long, curved outward; prefrontal single. Frontal large, a little longer than broad, much shorter than parietals. Supraocular divided on one side, entire on other; loreal longer than deep. Preoculars 2-2; postoculars 2-3. A total of 6 scales enter orbit on 1 side, 9 on other. Anterior temporals 1-1. Only first 6 upper labials on one side, first 8 on other, extend from head shields to labial border; those following are divided horizontally, first into double, then triple, then again double, rows. Their number, when only those entering margin are counted, may be given as 15-16; lower labials even more irregular. The very finely rugose anterior chin-shields are several times the size of the narrow posterior ones. Scales in 19 rows, striated and strongly keeled throughout. Ventrals 160; anal divided; subcaudals 63. The tail occupies 0.23 of total length which is 666 mm.

The uniform olive-brown of the back extends down on either side to the third row of scales and is marked only by 3 very obscure, black, longitudinal lines, each as wide as a scale. The belly and first 3 rows of scales on either side are uniformly light. The ventral surface of the tail is clouded except just behind the anus.

The 15 paratypes (Nos. 33708-710, 34428-436, and 34438-40) come from the type locality.

***Hemibungarus kelloggi*,¹ new species**

TYPE.—A. M. N. H. No. 33744; ♀; Ch'ungan Hsien, northwest Fukien Province, China; June-July, 1925; Clifford H. Pope.

DIAGNOSIS.—A *Hemibungarus* with 15 rows of scales, no longitudinal lines on the body, and head rather distinct from the neck.

DESCRIPTION OF TYPE.—Maxillary with a pair of large, grooved poison-fangs and 2 small, solid teeth separated by a space from the fangs. Rostral broader than deep; frontal a little longer than deep, as long as its distance from tip of snout, and much shorter than parietals. Diameter of eye equal to its distance from edge of lip; pupil round. Upper labials 7-7, third and fourth entering eye, sixth largest. Lower labials 6-6, four pairs in contact with anterior chin-shields. Preoculars 1-1; postoculars 2-2; anterior temporals 1-2; posterior temporals 2-2. Scales in 15 rows throughout. Ventrals 203; subcaudals 28, divided. Anal divided. Total length 774 mm., 0.09 of which is occupied by tail.

The dorsum is purplish brown with 3 sets of markings. The most conspicuous of these is made up of 22 light-edged, black cross-bands, each a scale length in width, distributed down the back and descending to the edge of the ventrals. They may even join the ventral spots. This set is continued on the tail where there are 3 additional bands. The second set of markings is composed of a series of paired, light-edged black spots, each about the size of a scale, located on either side of the central scale row midway between the cross-bands. On the tail these spots are a little irregular. The third set of markings is a broken series of small, black spots each occupying the center of a mid-dorsal scale. These spots are absent on the neck, tail, and the scales adjacent to the cross-bands.

The ventrum is milky white with 49 black blotches of varying size and outline disposed along its center. Five of the blotches fall behind the anus.

The head is black, crossed by 2 white bands; a narrow one beginning on the second and third upper labials and crossing over the snout at the juncture of the pre-frontals with the internasals; a much broader one with the form of a shallow V having its anterior edges on the posterior upper labials and its apex at the posterior tip of the frontal.

There are 3 paratypes, all from Ch'ungan Hsien, A. M. N. H. Nos. 33490, 34104, and 34588.

¹Named after Mr. Claude R. Kellogg, of the Fukien Christian University, who is devoting his life to the teaching of zoology in China.

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FOUR NEW SNAKES AND A NEW LIZARD FROM SOUTH CHINA¹

CLIFFORD H. POPE

Since recently describing a new lizard and 6 new snakes collected for the Third Asiatic Expedition of The American Museum of Natural History in Fukien Province, China (American Museum Novitates, June 23, 1928), I have found 5 more new forms, 3 of which I describe here as new species, 2 as new subspecies. Four of the 5 were collected for the Third Asiatic Expedition, 3 by myself in Kiangsi and Fukien Provinces, and 1 by Walter Granger in Yunnan Province. The fifth, also from Yunnan, was secured for the Museum by Mr. John Graham.

The American Museum's earlier reptile collections from China were reported by Karl P. Schmidt in 1927. A report on all the more recently collected Chinese reptiles, now in manuscript form, will appear shortly. It will contain an account of all the Museum's Chinese reptiles not already treated by Schmidt.

Kuatun, from where many species have been described, is a village in the mountains of Ch'ungan Hsien, the type locality for two of the forms described herein.

SAURIA

***Gekko japonicus hokouensis*, new subspecies**

TYPE.—A. M. N. H. No. 35090; ♂; Hok'ou, northeast Kiangsi Province, China; June 28–July 12, 1926; Clifford H. Pope.

DIAGNOSIS.—Differs from typical *japonicus* chiefly in having a large, undivided tubercular scale on each side of the base of the tail.

DESCRIPTION OF TYPE.—Head moderately large; snout longer than distance between eye and ear-opening, about twice diameter of eye; ear-opening suboval, oblique. Digits moderately expanded with slight but distinct rudiments of web; the single pair of chin-shields longer than broad, bordered in front and on the sides by mental, 2 lower labials, and 2 shields each half as large as the chin-shields; bordered behind by 4 small, subequal shields. The back and limbs are covered with small, granular scales intermixed with numerous, small, subconical tubercules which are

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 82.

larger and more numerous along the upper sides than down the center of the back; preanal pores 6; single tubercular scale on each side of base of tail three-fourths as long as diameter of eye. Length from snout to vent 56 mm., from vent to end of tail (which has a bit of end missing) 65 mm.

The color is grayish brown with 5 very indistinct, slightly darker cross-bands on the back, and 9 rather distinct ones across the tail.

There are 14 paratypes from the type locality (Nos. 35087-100), and 1 from Ch'ungan Hsien (No. 33491).

SERPENTES

Colubridæ

Zaocys dhumnades montanus, new subspecies

TYPE.—A. M. N. H. No. 34334; ♀; Ch'ungan Hsien, northwest Fukien Province, China. April-September, 1928; Clifford H. Pope.

DIAGNOSIS.—Distinguished from the typical form by a higher ventral and caudal count. The ventrum is much darker than in typical *dhumnades*.

DESCRIPTION OF TYPE.—Rostral broader than deep, visible from above; internasals shorter than the prefrontals, which are not as long as their distance from end of snout; frontal almost as long as its distance from tip of snout, just as long as parietals which are nearly as broad as long. Loreal longer than deep; a large preocular with a small one below; 2 postoculars; 2 anterior, and 2 posterior temporals. Eight upper labials, fourth and fifth entering eye; 10 lower labials, first 5 in contact with anterior chin-shields. Scales reduced from maximum of 16 to minimum of 14 at a point opposite 103d ventral; smooth on neck, 2 rows sharply keeled at midbody and before vent. Ventrals 195; anal divided; subcaudals 123+. Total length 1475 mm.+, about 0.28 occupied by tail.

The posterior half of the body above and below is slaty black. The milky color of the throat and ventral surface of the head merges with the darkening belly color. Anteriorly, on either side of the 2 mid-dorsal rows of scales, is a black stripe, itself covering 2 scale rows. Below this stripe the scales have black borders and bluish centers. The lateral tips of the ventrals are edged with black. Some distance posterior to the head the scales of the third row lose their light centers forming a narrow, black stripe that is soon lost in the uniform black of the posterior section of the snake. The top and upper sides of the head are slate-colored.

There are 11 paratypes from the type locality (Nos. 33627-632 and 34329-333), and 1 from Yenping (No. 33242). I also place A. M. N. H. Nos. 17445, 17452 and 24621 from Changsha, Hunan Province, here. The Changsha specimens were collected by Mr. J. W. Williams.

Dinodon flavozonatum, new species

TYPE.—A. M. N. H. No. 34371; ♂; Ch'ungan Hsien, northwest Fukien Province, China; April-September, 1926; Clifford H. Pope.

DIAGNOSIS.—Closely allied to *rufozonatum* from which it differs chiefly in having yellow instead of red cross-bands.

DESCRIPTION OF TYPE.—Rostral broader than deep, plainly visible from above; internasals much shorter than prefrontals, which are a little shorter than frontal; frontal slightly longer than broad, just as long as its distance from rostral; length of

parietals equals their distance from end of snout. Loreal longer than deep, not entering eye. One pre- and 2 postoculars; temporals 2-3. Eight upper labials, third, fourth, and fifth entering eye; 10 lower labials, first 5 in contact with anterior chin-shields which are as long as, and slightly broader than, posterior. Scales in 17 rows to a point opposite seventy-first ventral plate from anus where fourth row drops out; in 15 rows posterior to this; 7 rows feebly keeled at midbody; all scales smooth on neck. Ventrals 218; anal entire; subcaudals 87; apical pits double. Total length 965 mm., 0.20 of which is tail length.

The uniformly black ground-color of the dorsum is crossed anterior to the vent at regular intervals by 68 narrow, yellow bands each about half as wide as a scale is long. Every band divides on the fifth scale-row, each half joining a branch from the adjacent ones before descending to the ventrals. This lateral pattern is not very distinct and encroaches slightly on the white ventrals. Most of the 21 tail-bands are as wide as a scale is long, and none of them splits laterally. The subcaudals are black, weakly light mottled. The top of the head is black save for a yellow stripe from behind the eye to the angle of the mouth; narrow yellow borders on some of the plates, and a nuchal, V-shaped, yellow band with its apex on the posterior tips of the parietals. The first 2 and the eighth or last upper labials are black, the rest black and yellow. The throat is white, except for black trimmings on the anterior lower labials. The yellow of the dorsum fades with preservation into a dirty white.

The 19 paratypes (Nos. 33641-647, 34370 and 34372-382) come from the type locality.

***Bungarus wanghaotingi*,¹ new species**

TYPE.—A. M. N. H. No. 35230; ♀; Yuan Kiang, southwestern Yunnan Province, China; November, 1926; Walter Granger.

DIAGNOSIS.—Allied to *caudidus* from which it differs chiefly in having a higher ventral count. The dorsal bands are much more numerous than in *multicinctus*.

DESCRIPTION OF TYPE.—Rostral much broader than high, touching 6 scales, its suture with first upper labial about one-fifth as long as that with nasal; internasals two-thirds as long as prefrontals, which in turn are three-fourths as long as frontal; frontal slightly shorter than its distance from tip of snout, just as wide as parietals, which are as long as their distance from rostral; a single scale between nasal and eye. Seven upper labials, third and fourth entering orbit; 2 postoculars, upper twice as large as lower; one temporal; 7 lower labials, first 4 in contact with anterior chin-shields, fourth much the largest; posterior pair of chin-shields shorter than anterior. Scales in 15 rows throughout. Ventrals 228; subcaudals 53. Total length 484 mm., 0.13 occupied by tail; anal and subcaudals entire.

The black ground-color is crossed by 23 white bands on the body, 11 on the tail. These white bands cover 3 mid-dorsal scales on the neck where they are 16 scale-lengths apart, while posteriorly they are only half as wide and 4 scale-lengths apart. All of them expand before joining the uniform white of the belly, and near the center of each, at its juncture with the belly, there is a small, dark spot. Many of the white bands have a few black-centered scales. The black of the ground-color barely encroaches on the tips of the ventrals. Above the upper labials, the top and sides of the

¹Named for Mr. Wang Hao-t'ing, of Peking, who for two years faithfully painted reptiles and amphibians from life for the Third Asiatic Expedition.

head are black. On either side of the neck, just back of the parietals, the scales are dimly white-tipped.

The single paratype (No. 35229) comes from the type locality.

***Amblycephalus niger*, new species**

TYPE.—A. M. N. H. No. 22703; ♀; Yunnanfu, Yunnan Province, China; John Graham.

DIAGNOSIS. — An *Amblycephalus* with a black tail and a large amount of black on the dorsum. The loreal is excluded from the eye, and at midbody 7 rows of scales are keeled.

DESCRIPTION OF TYPE.—Rostral as broad as deep; internasals in contact with loreal and half as large as prefrontals which enter the orbit; frontal, without its posterior projection, about as broad as deep, much shorter than, but about as wide as parietals which are as long as their distance from tip of snout. Loreal widely separated from eye by a distinct preocular and enlarged end of a subocular; a long, narrow scale separates eye from upper labials; anterior temporals 2, separated from eye by narrow scale below, wider one above; posterior temporals 3-3. Upper labials 7-7; lower, 7-7, first pair narrowly in contact behind mental; first 4 in contact with anterior chin-shields which are longer than broad; second pair slightly broader than long, third much broader than long; diameter of eye equals half interorbital space. Scales in 17 rows, vertebral row not enlarged. Ventrals 165; subcaudals 64; anal entire. Total length 502 mm., 0.22 occupied by tail.

The solid black of the top of the head extends down about to the loreal and lower anterior temporal where it begins to break into profuse spots which in turn become less profuse until, on the upper labials, they are sparse. On the lower labials and chin-shields the spots are reduced to a little scattered speckling. The neck and back are black but the black is broken on the sides by very irregular, light areas extending upward from the light ventrals, and suggesting the remnants of bands that have all but disappeared. Toward the tail these light areas are much more marked than they are anteriorly. The belly is light except for very irregular, sparse mottling mostly in the form of spots or narrow intrusions of the black of the dorsum. The tail is uniformly black with a little light mottling on the first 10 to 12 subcaudals.

The type is unique and was reported by Schmidt in 1927 as *chinensis*.

A. niger differs markedly in color from all the other Chinese species. In addition it is distinguished from all but *yunnanensis* and *stanleyi* by its keeled scales. In *yunnanensis* the loreal reaches the eye and the vertebral row is enlarged, so from this species *niger* is amply distinct. The low caudal count in *stanleyi* separates it not only from *niger* but the rest of the Chinese species as well.

BULLETIN
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**Article I.—CHINESE FRESH-WATER FISHES IN THE
AMERICAN MUSEUM OF NATURAL HISTORY'S
COLLECTIONS¹**

A PROVISIONAL CHECK-LIST OF THE FRESH-WATER FISHES OF CHINA²

BY J. T. NICHOLS

Incident to study of the Museum's recently acquired Asiatic collections, a number of new species and races of Chinese fresh-water fishes have been described. A somewhat more complete report on Chinese material to hand may now appropriately be made by listing all the species examined. Much more study is necessary before an authoritative check-list of the fishes of this area can be drawn up, but it should be helpful to others working to that end to list, with species contained in our collections, those encountered in the literature which offhand appear to be valid. The asterisk (*) signifies a specimen in The American Museum of Natural History.

Only strictly fresh-water fishes are included in this list, marine forms, the occurrence of which in fresh water is fortuitous, are not included; nor are representatives of essentially marine groups, even when such species occur regularly in fresh as well as in salt water.

The area is restricted to old China from the outer limits of Chihli Province on the northeast to the outer limits of Yunnan Province on the southwest, and does not include Manchuria, Mongolia, Tonkin, or Tibet.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 83.

²This covers material in The American Museum of Natural History up to June, 1926. Some additional material has been obtained by the Asiatic Expeditions, and further collections of considerable importance are in prospect.

ACIPENSERIDÆ**ACIPENSER** Linnæus

LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., p. 237. Type: *Acipenser sturio* Linnæus.

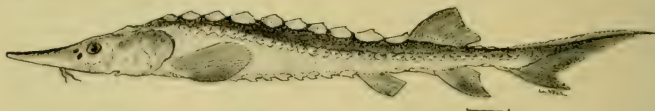


Fig. 1. *Acipenser dabryanus*, 318 mm. standard length.

***Acipenser dabryanus** DUMÉRIL, 1868, Nouv. Arch. Mus., IV, p. 98, Pl. XXII, fig. 1. Yangtze.

Shanghai (Gee). Specimen examined from Tungting Lake (Hunan).

Acipenser sinensis GRAY, 1834, Proc. Zool. Soc. London, II, p. 122. China

HUSO Brandt and Ratzeburg

BRANDT AND RATZEBURG, 1883, 'Med. Zool.,' II, p. 3. Type: *Acipenser huso* Linnæus.

Huso dauricus (GEORGI).

Acipenser dauricus GEORGI, 1775, 'Reis. Russ.,' I, p. 352. Dauria (Siberia).
Yellow River (Gee).

POLYDONTIDÆ**PSEPHURUS** Günther

GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 250. Type: *Polyodon gladius* Martens.

Psephurus gladius (MARTENS).

Polyodon gladius MARTENS, 1862, Monatsber. Akad. Wiss., Berlin, 1861, p. 476.
Yangtze.

Shanghai (Gee).

ELOPIDÆ**MEGALOPS** Lacépède

LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 289. Type: *Megalops filamentosus* Lacépède = *Clupea cyprinoides* Broussonet.

Megalops cyprinoides (BROUSSONET).

Clupea cyprinoides BROUSSONET, 1782, 'Ichthyologia,' I, Pl. ix. Tropical Oceans.

Hainan (Oshima).

ENGRAULIDÆ**COILIA** Gray

GRAY, 1831, 'Zool. Misc.,' pp. 7-10. Type: *Coilia hamiltoni* Gray.

***Coilia nasus** TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 243, Pl. CIX, fig. 4. Japan.

Shanghai, Ning Po, Pei Ho, Tientsin (Gee). Specimens examined from Anhwei.

***Coilia brachygnathus** KREYENBERG AND PAPPENHEIM, 1908, Sitz. Gesell. Nat. Fr. Berlin, p. 96. Tungting and Hankau.

Specimens examined from Tungting Lake (Hunan).

SALMONIDÆ**PLECOGLOSSUS** Temminck and Schlegel

TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 229. Type: *Plecoglossus altivelis* Temminck and Schlegel.

Plecoglossus altivelis TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 229, Pl. cv, fig. 1. Japan.

North China (Reeves, 1927).

SALANGIDÆ**SALANGICHTHYS** Bleeker

BLEEKER, 1860, Act. Soc. Sc. Indo Neerl., VIII, p. 101. Type: *Salanx microdon* Bleeker.

***Salangichthys microdon** (BLEEKER).

Salanx microdon BLEEKER, 1860, Act. Soc. Sc. Indo Neerl., VIII, p. 100. Tokio.

Specimens examined from Tungting Lake (Hunan).

SALANX Cuvier

CUVIER, 1817, 'Règne Animal,' II, p. 185. Type: *Salanx cuvieri* Cuvier and Valenciennes.

(SALANX) Cuvier

CUVIER, 1817, 'Règne Animal,' II, p. 185. Type: *Salanx cuvieri* Cuvier and Valenciennes.

***Salanx cuvieri** CUVIER AND VALENCIENNES, 1849, 'Hist. Nat. Poiss.,' XXII, p. 360. No locality.

Specimens examined from Tungting Lake (Hunan).

(LEUCOSOMA) Gray

GRAY, 1831, 'Zool. Misc.,' p. 4. Type: *Leucosoma reevesi* Gray = *Albula chinensis* Osbeck.

***Salanx chinensis** (OSBECK).

Albula chinensis OSBECK, 1765, 'Reise Ostindien, China,' p. 309. China.

Specimens examined from Fukien.

(PROTOSALANX) Regan

REGAN, 1908, Ann. Mag. Nat. Hist., (8) II, p. 444. Type: *Salanx hyalocranius* Abbott.

Salanx hyalocranius ABBOTT, 1901, Proc. U. S. Nat. Mus., XXIII, p. 490, Fig. Tientsin.

Salanx anderssoni (RENDAHL).

Protosalanx anderssoni RENDAHL, 1923, Zool. Anz., LVI, p. 92. China.

(PARASALANX) Regan

REGAN, 1908, Ann. Mag. Nat. Hist., (8) II, p. 444. Type: *Parasalanx gracillimus* Regan.

Salanx gracillimus (REGAN).

Parasalanx gracillimus REGAN, 1908, Ann. Mag. Nat. Hist., (8) II, p. 446. Shanghai.

Salanx angusticeps (REGAN).

Parasalanx angusticeps REGAN, 1908, Ann. Mag. Nat. Hist., (8) II, p. 446. China.

Salanx longianalis (REGAN).

Parasalanx longianalis REGAN, 1908, Ann. Mag. Nat. Hist., (8) II, p. 446. Liao-ho, Northern China.

Salanx annitæ (VAN DAM).

Parasalanx annitæ VAN DAM, 1926, Ann. Mag. Nat. Hist., (9) XVIII, p. 342. Peitaiho (very likely marine).

(HEMISALANX) Regan

REGAN, 1908, Ann. Mag. Nat. Hist., (8) II, p. 444. Type: *Hemisalanx prognathus* Regan.

Salanx prognathus (REGAN).

Hemisalanx prognathus REGAN, 1908, Ann. Mag. Nat. Hist., (8) II, p. 445. Shanghai.

MONOPTERIDÆ

FLUTA Bloch and Schneider

BLOCH AND SCHNEIDER, 1801, 'Syst. Ich.,' p. 525. Type: *Monopterus javanensis* Lacépède = *Fluta alba* (Zuiew).

Fluta alba (ZUIEW).

Murana alba ZUIEW, 1793, Nov. Act. Acad. Sc. Petropol., VII, p. 299. No locality.

***Fluta alba cinerea** (RICHARDSON).

Monopterus cinereus RICHARDSON, 1844, 'Voy. "Sulph.,"' p. 117, Pl. LII. Woon-sung.

Specimens examined from Yunnan, Szechwan, Shansi, Tungting Lake (Hunan).

***Fluta alba xanthognatha** (Richardson).

Monopterus xanthognathus RICHARDSON, 1844, 'Voy. "Sulph.,"' p. 118, Pl. LII. Canton.

Specimens examined from Fukien, Hainan Island.

MASTACEMBELIDÆ**MASTACEMBELUS** Scopoli

SCOPOLI, 1777, 'Int. Hist. Nat.,' p. 458, after Gronow. Type: *Ophidium simack* Walbaum = *Rhynchobdella halepensis* Bloch and Schneider.

Mastacembelus armatus (Lacépède).

Macrogathus armatus Lacépède, 1800, 'Hist., Nat. Poiss.,' II, p. 286. No. locality.

***Mastacembelus armatus undulatus** (McClelland).

Macrogathus undulatus McClelland, 1844, Calcutta Journ. Nat. Hist., IV, p. 398, Pl. xxii. Chusan-Ningpo region.

Specimens examined from Hainan Island.

***Mastacembelus sinensis** (Bleeker).

Rhynchobdella sinensis Bleeker, 1870, Versl. Ak. Amst., IV, p. 249. China.

Ningpo, Shanghai (Gee). Specimens examined from Tungting Lake (Hunan), Anhwei.

ANGUILLIDÆ**ANGUILLA** Shaw

SHAW, 1803, 'Gen. Zool. or Syst. Nat. Hist.,' IV, p. 15. Type: *Anguilla vulgaris* Shaw (*Muræna anguilla* Linnæus).

***Anguilla japonica** TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 258, Pl. cxiii, fig. 2. Japan.

Ningpo (Gee). Specimens examined from Tungting Lake (Hunan), Fukien, Hainan Island.

***Anguilla mauritiana** Bennett, 1831, Proc. Comm. Zoöl. Soc., p. 128. Mauritius.

East Indian Oceans and Archipelagoes in general. Hainan (Oshima). Specimens examined from Fukien.

SILURIDÆ**PARASILURUS** Bleeker

BLEEKER, 1862, Versl. Akad. Amst., XIV, p. 394. Type: *Parasilurus japonicus* Temminck and Schlegel = *Silurus asotus* Linnæus.

***Parasilurus asotus** (LINNÆUS).

Silurus asotus LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., p. 304. Asia.

Tientsin, Ningpo, Shanghai, Chingwantao (Gee). Specimens examined from Shansi, Tungting Lake (Hunan), Anhwei, Fukien.

Parasilurus cinereus (DABRY DE THIERSANT).

Silurus cinereus DABRY DE THIERSANT, 1872, 'Pisc. Chin.,' Pl. XLVII, fig. 1. Yangtze.

Parasilurus grahami (REGAN).

Silurus grahami REGAN, 1907, Ann. Mag. Nat. Hist., XIX, p. 64. Yunnan.

***Parasilurus mento** (REGAN).

Silurus mento REGAN, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 192. Yunnan.

Specimens examined from Yunnan.

***Parasilurus cochinchinensis** (CUVIER AND VALENCIENNES).

Silurus cochinchinensis CUVIER AND VALENCIENNES, 1839, 'Hist. Nat. Poiss.,' XIV, p. 352. Cochinchina.

Specimens examined from Hainan Island, Fukien.

SILURODON Kner

KNER, 1869, "'Novara," Fische,' p. 305. Type: *Silurodon hexanema* Kner.

Silurodon hexanema KNER, 1869, "'Novara," Fische,' p. 305, Pl. XII, fig. 2. Probably Shanghai.

AORIA Jordan

JORDAN, 1919, Proc. Ac. Phila., 1919, p. 341. Type: *Bagrus lamarii* Cuvier and Valenciennes.

Aoria argentivittata (REGAN).

Macrones argentivittatus REGAN, 1905, Rev. Suisse Zool., XIII, p. 390, Pl. v, fig. 2. China.

Aoria pulcher (CHAUDHURI).

Macrones pulcher CHAUDHURI, 1912, Rec. Ind. Mus., VI, p. 20, Pl. I, fig. 4. Yunnan.

Aoria sinensis (BLEEKER).

Macrones sinensis BLEEKER, 1873, Ned. Tijds. Dierk., IV, p. 153. China.

CRANOGLANIS Peters

PETERS, 1880, Monatb. Akad. Wiss. Berl., II, p. 1030, Type: *Cranoglanis sinensis* Peters.

Cranoglanis sinensis PETERS, 1880, Monatb. Akad. Wiss. Berl., II, p. 1030, Fig. 1. Hongkong.

PSEUDOBAGRUS Bleeker

BLEEKER, 1860, Act. Soc. Sci. Indo-Ned., VIII, p. 87. Type: *Bagrus aurantiacus* Temminck and Schlegel.

***Pseudobagrus vachellii** (RICHARDSON).

Bagrus (?) vachellii RICHARDSON, 1846, 'Ich. Chin.,' Rept. XV Meet. Brit. Ass., p. 284. Canton.

Ningpo (Gee). Specimens examined from Tungting Lake (Hunan), Fukien.

Pseudobagrus eupogon BOULENGER, 1892, Ann. Mag. Nat. Hist., (6) IX, p. 247. Shanghai.

***Pseudobagrus fulvidraco** (RICHARDSON).

Pimelodus ? fulvidraco RICHARDSON, 1846, Rept. XV Meet. Brit. Ass., p. 286. Canton.

Shanghai, Canton (Gee). Specimens examined from Chihli, Shansi, Tungting Lake (Hunan), Anhwei, Fukien.

***Pseudobagrus intermedius** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 331, Fig. 5. Hainan.

***Pseudobagrus nitidus** SAUVAGE AND DABRY DE THIERSAINT, 1874, Ann. Sci. Nat., (6) I, Art. 5, p. 5. Yangtze.

Specimens examined from Tungting Lake (Hunan).

***Pseudobagrus virgatus** (OSHIMA).

Aoria virgatus OSHIMA, 1926, Annot. Zool. Japon., XI, p. 4. Kachek River, Hainan.

Specimens examined from Hainan.

LEIOCASSIS Bleeker

BLEEKER, 1858, Nat. Tijds. Ned.-Ind., XV, p. 225. Type: *Leiocassis micropogon* Bleeker.

(NASOCASSIS) Nichols

NICHOLS, 1925, Amer. Mus. Novitates, No. 185, p. 1. Type: *Liocassis longirostris* Günther.

Leiocassis crassilabris GÜNTHER.

Liocassis crassilabris GÜNTHER, 1864, 'Cat.,' V, p. 88. China.

***Leiocassis crassilabris crassilabris** GÜNTHER.

Liocassis crassilabris GÜNTHER, 1864, 'Cat.,' V, p. 88. China.

Specimens examined from Tungting Lake (Hunan).

***Leiocassis crassilabris macrops** NICHOLS, 1926, Amer. Mus. Novitates, No. 214, p. 2, Fig. 2. Fukien.

Leiocassis crassirostris REGAN.

Liocassis crassirostris REGAN, 1913, Ann. Mag. Nat. Hist., (8) XI, p. 552. Szechwan.

***Leiocassis longirostris** GÜNTHER.

Liocassis longirostris GÜNTHER, 1864, 'Cat.,' V, p. 87. Japan (should be China).

Ningpo, probably Hongkong (Gee). Specimens examined from Tungting Lake (Hunan).

(DERMOCASSIS) Nichols

NICHOLS, 1925, Amer. Mus. Novitates, No. 185, p. 1. Type: *Bagrus ussuriensis* Dybowski.

***Leiocassis medianalis** (REGAN).

Macrones medianalis REGAN, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 194. Yunnan.

Leiocassis emarginatus REGAN.

Liocassis emarginatus REGAN, 1913, Ann. Mag. Nat. Hist., (8) XI, p. 553. Szechwan.

Leiocassis pratti (Günther).

Macrones pratti GÜNTHER, 1892, in Pratt, 'Snows of Tibet, etc.,' p. 245, Pl. 1, fig. B. Szechwan.

***Leiocassis similis** NICHOLS, 1926, Amer. Mus. Novitates, No. 214, p. 1, Fig. 1. Fukien.

***Leiocassis tæniatus** (GÜNTHER).

Macrones (Liocassis) tæniatus GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 245. Shanghai.

Ningpo (Gee). Specimen examined from Fukien.

Leiocassis taphrophilus (SAUVAGE AND DABRY DE THIERSANT).

Hemibagrus taphrophilus SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., (6) I, Art. 5, p. 6. Caneau du Tschuang occidental.

Ningpo (Gee).

***Leiocassis tenuis** (GÜNTHER).

Macrones (Pseudobagrus) tenuis GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 244. Shanghai.

Specimen examined from Fukien.

Leiocassis truncatus REGAN.

Liocassis truncatus REGAN, 1913, Ann. Mag. Nat. Hist., (8) XI, p. 553. Szechwan.

***Leiocassis ussuriensis** (DYBOWSKI).

Bagrus ussuriensis DYBOWSKI, 1872, Verh. Zool.-Bot. Gesell. Wien, XXII, p. 210. Ussuri River.

Specimens examined from Shansi, Tungting Lake (Hunan).

HEMIBAGRUS Bleeker

BLEEKER, 1863, Ned. Tijds. Dierk., I, p. 94. Type: *Bagrus nemurus* Valenciennes.

(MACROPTEROBAGRUS) Nichols

NICHOLS, 1925, Amer. Mus. Novitates No. 185, p. 1. Type: *Hemibagrus macropterus* Bleeker.

***Hemibagrus macropterus** BLEEKER, 1870, Versl. Akad. Amst., (2) IV, p. 258, plate. Yangtze River.

Specimens examined from Tungting Lake (Hunan), Anhwei.

LIOBAGRUS Hilgendorf

HILGENDORF, 1878, Sitz. Ges. Nat. Fr. Berlin, p. 155. Type: *Liobagrus reini* Hilgendorf.

***Liobagrus anguillicauda** Nichols, 1926, Amer. Mus. Novitates, No. 224, p. 1, Fig. 1. Fukien.

Liobagrus marginatus (GÜNTHER).

Amblyceps marginatus GÜNTHER, 1892, in Pratt, 'Snows of Tibet, etc.,' p. 245, Pl. II, fig. A. Szechwan.

***Liobagrus nigricauda** REGAN, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 193. Yunnan.

Specimens examined from Yunnan.

Liobagrus styani REGAN, 1908, Ann. Mag. Nat. Hist., (8) I, p. 152. South Hupeh.

GLYPTOSTERNON McClelland

MCCLELLAND, 1842, Journ. Nat. Hist., Calcutta, II, p. 584. Type: *Glyptosternon reticulatus* McClelland.

Glyptosternon conirostre STEINDACHNER, 1867, Sitzb. Ak. Wiss. Wien, LV, p. 532, Pl. v, fig. 2; Pl. VI, fig. 4. Simla.

Mountain streams running into the Min River, Szechwan.—Günther, 1892, in Pratt, 'Snows of Tibet, etc.'

Glyptosternon fokiensis RENDAHL, 1925, Zool. Anz. (Leipzig), LXIV, p. 307. Fokien, Lien-Cheng-Hsien, Lan-Hiao.

***Glyptosternon sinense** REGAN, 1908, Ann. Mag. Nat. Hist., I, p. 110. Tungting Lake.

Specimens examined from Tungting Lake (Hunan).

***Glyptosternon hainanensis** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 333, Fig. 7. Hainan.

ERETHISTES Müller and Troschel

MÜLLER AND TROSCHER, 1849, Hor. Zool. Bes. Abb. Fische, III, p. 12. Type: *Erethistes pusillus* Müller and Troschel.

Erethistes asperus (McCLELLAND).

Pimelodus asperus McCLELLAND, 1844, Calcutta Journ. Nat. Hist., IV, p. 404, Pl. XXIV, fig. 2. Chusan.

EXOSTOMA Blyth

BLYTH, 1860, Journ. Asiat. Soc. Bengal, XXIX, p. 155. Type: *Exostoma berdmorei* Blyth.

(**EUCHILOGLANIS**) Regan

REGAN, 1911, Ann. Mag. Nat. Hist., (8) VIII, p. 564. Type: *Chimarrichthys davidi* Sauvage.

Exostoma davidi (SAUVAGE).

Chimarrichthys davidi SAUVAGE, 1874, Rev. Mag. Zoöl., II, p. 332. Thibet. River Ya (Günther, 1896).

Exostoma myzostoma (NORMAN).

Euchiloglanis myzostoma NORMAN, 1923, Ann. Mag. Nat. Hist., (9) XI, p. 562. Yunnan.

(**GLARIDOGLANIS**) Norman

NORMAN, 1925, Ann. Mag. Nat. Hist., (9) XV, p. 574. Type: *Exostoma andersonii* Day.

Exostoma andersonii DAY, 1869, Proc. Zoöl. Soc., p. 524. Yunnan.

CLARIAS Scopoli

SCOPOLI, 1777, following Gronow, 1763, 'Zoophylaceum,' p. 100. Type: *Clarias orontis* Günther.

***Clarias fuscus** (Lacépède).

Macropteronotus fuscus Lacépède, 1803, 'Hist. Nat. Poiss.,' V, p. 88, Pl. II, fig. 2. China.

Specimens examined from Yunnan, Fukien, Hainan Island.

CATOSTOMIDÆ

MYXOCYPRINUS Gill

GILL, 1878, Johnson's 'Cyclopædia,' p. 1574. Type: *Carpiodes asiaticus* Bleeker.

Myxocyprinus asiaticus (BLEEKER).

Carpiodes asiaticus BLEEKER, 1865, Ned. Tijds. Dierk., II, p. 19 (? probably northern) China.

***Myxocyprinus asiaticus asiaticus** (BLEEKER).

Carpiodes asiaticus BLEEKER, 1865, Ned. Tijds. Dierk., II, p. 19 (? probably northern) China.

Specimens examined from Anhwei.

****Myxocyprinus asiaticus chinensis*** (DABRY DE THIERSANT).

Carpiodes chinensis DABRY DE THIERSANT, 1872, 'Pisc. Chin.,' p. 182, Pl. XL, fig. 1. Yangtze.

Specimens examined from Tungting Lake (Hunan).

****Myxocyprinus asiaticus fukiensis*** NICHOLS, 1925, Amer. Mus. Novitates, No. 177, p. 8. Fukien.

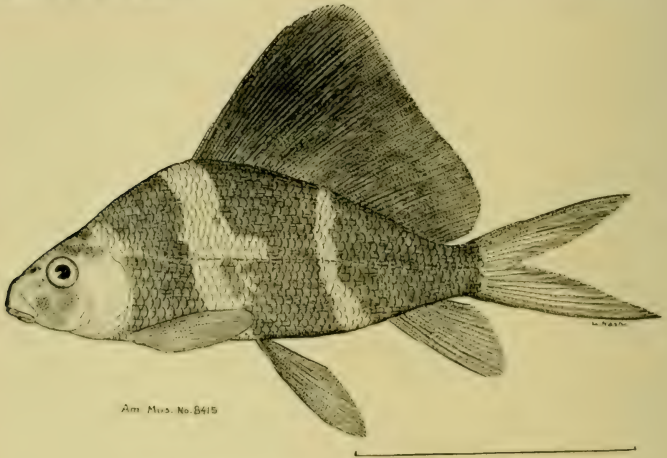


Fig. 2. *Myxocyprinus asiaticus fukiensis*, type.

CYPRINIDÆ

CYPRINUS Linnaeus

LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 320, after Artedi. Type: *Cyprinus carpio* Linnaeus.

****Cyprinus carpio*** LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., p. 320. Europe. Chihli Prov., Canton, Peking (Gee). Specimens examined from Tungting Lake (Hunan), Swatow, Hainan.

Cyprinus fossicola RICHARDSON.

Cyprinus (?) fossicola RICHARDSON, 1845, 'Ich. Chin.,' p. 291, attributed to Gray. China. Canton (Gee).

****Cyprinus micristius*** REGAN, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 332. Yunnan.

CARASSIUS Nilsson

NILSSON, 1832, 'Prod. Ichth. Scand.,' IV, p. 290. Type: *Cyprinus carassius* Linnæus.

Carassius carassius (LINNÆUS).

Cyprinus carassius LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., p. 321. Europe.

North China (Gee).

***Carassius auratus** (LINNÆUS).

Cyprinus auratus LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., p. 322. China and Japan.

Shanghai, Ningpo, Canton, Yangtze River, Pei Ho, Hongkong, Chihli Prov. (Gee). Specimens examined from Chihli, Shansi, Anhwei, Tungting Lake (Hunan), Szechwan, Yunnan, Fukien, Hainan.

CIRRHINUS Oken

OKEN, 1817, Isis, pp. 1181-1183; after Cuvier. Type: *Cyprinus cirrhosus* Bloch.

Cirrhinus chinensis GÜNTHER.

Cirrhina chinensis GÜNTHER, 1868, 'Cat.,' VII, p. 36. China.

OSTEOCHILUS Günther

GÜNTHER, 1868, 'Cat.,' VII, p. 40. Type: *Rohita melanopleura* Bleeker.

***Osteochilus salsburyi** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 348, Fig. 18. Hainan.

MYSTACOLEUCUS Günther

GÜNTHER, 1868, 'Cat.,' VII, p. 206. Type: *Systomus padangensis* Bleeker.

Mystacoleucus mandarinus RENDAHL, 1926, Ark. Zool., 18B (2), paper No. 11, pp. 1-4. China.

BARBUS Cuvier

CUVIER, 1817, 'Règne Animal,' 1st Ed., II (Reptiles, Fishes, etc.), p. 192. Type: *Cyprinus barbatus* Linnæus.

(BARBODES) Bleeker

BLEEKER, 1859, Nat. Tijd. Ned.-Ind., XX, p. 431. Type: *Systomus belinka* McClelland.

***Barbus cogginii** CHAUDHURI, 1911, Rec. Ind. Mus., VI, p. 16, Pl. Yunnan.

Specimens examined from Yunnan.

Barbus deauratus CUVIER AND VALENCIENNES, 1842, 'Hist. Nat. Poiss.,' XVI, p. 188. Cochinchina.

Canton (Gee).


***Barbus grahami** REGAN, 1904, Ann. Mag. Nat. Hist., XIII, p. 190. Yunnan. Specimens examined from Yunnan.


Barbus gregorii NORMAN, 1923, Ann. Mag. Nat. Hist., (9) XI, p. 562. Yunnan.

Barbus margaritanus ANDERSON, 1878, 'Expeditions to Western Yunnan,' p. 867, Pl. LXXIX, fig. 1. Western Yunnan border.

Barbus simus SAUVAGE AND DABRY DE THIERSANT.

Barbus (Systomus) sinus SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., (6) I, Art. 5, p. 8. China.


 **Barbus sinensis** (BLEEKER).

 *Puntius (Barbodes) sinensis* BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 17, Pl. iii, fig. 2. Yangtze?.

Barbus yunnanensis REGAN, 1904, Ann. Mag. Nat. Hist., XIII, p. 191. Yunnan.

(**SPINIBARBUS**) Oshima

OSHIMA, 1919, Ann. Carneg. Mus., XII, p. 217. Type: *Spinibarbus hollandi* Oshima.

 ***Barbus nigrodorsalis** (OSHIMA).

Spinibarbus nigrodorsalis OSHIMA, 1926, Annot. Zool. Japon., XI, p. 10. Kachek River, Hainan.

Specimens examined from Nodda, Hainan.

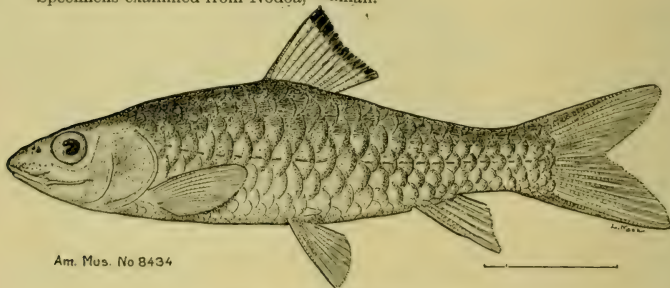


Fig. 3. *Barbus caldwelli*, type.

***Barbus caldwelli** NICHOLS, 1925, Amer. Mus. Novitates, No. 185, p. 2. Fukien.

***Barbus denticulatus** (OSHIMA).

Spinibarbichthys denticulatus OSHIMA, 1926, Annot. Zool. Japon., XI, p. 11. Kachek River, Hainan.

Specimens examined from Nodda, Hainan.

(**TOR**) Gray

GRAY, 1833, 'Illust. Ind. Zool.,' II, p. 96. Type: *Cyprinus tor* Hamilton = *Tor hamiltoni* Gray.

Barbus brevifilis Peters.

Barbus (Labeobarbus) brevifilis PETERS, 1880, Monatb. Akad. Wiss. Berl., p. 1033, Fig. 4. Hongkong.

(**PUNTIUS**) Hamilton-Buchanan

HAMILTON-BUCHANAN, 1822, 'Fishes in Ganges,' p. 388. Type: *Cyprinus puntio* Hamilton-Buchanan.

***Barbus semifaciolatus** GÜNTHER, 1868, 'Cat.,' VII, p. 484. China.

Specimens examined from Hainan.

***Barbus snyderi** (OSHIMA).

Puntius snyderi OSHIMA, 1919, Ann. Carn. Mus., XII, p. 216, Pl. L, fig. 2.

Formosa.

Specimens examined from Fukien.

(**LISSOCHILICHTHYS**) Oshima

OSHIMA, 1920, Proc. Acad. Phila., 1920, p. 124. Type: *Lissochilichthys matsudai* Oshima.

***Barbus matsudai** (OSHIMA).

Lissochilichthys matsudai OSHIMA, 1920, Proc. Acad. Nat. Sci. Phila., LXXII, p. 124, Pl. III, fig. 2. Formosa. Kachek River, Hainan (Oshima, as *Barbodes paradoxus*). Specimens examined from Fukien.

Barbus lissochiloides, new name.

Crossochilus fasciatus STEINDACHNER, 1892, Denks. Akad. Wien, LIX, pt. 1, p. 372, Pl. IV, figs. 2-2b. Shanghai. Name preoccupied in *Barbus*.

***Barbus barbodon** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 345, Fig. 16. Hainan.

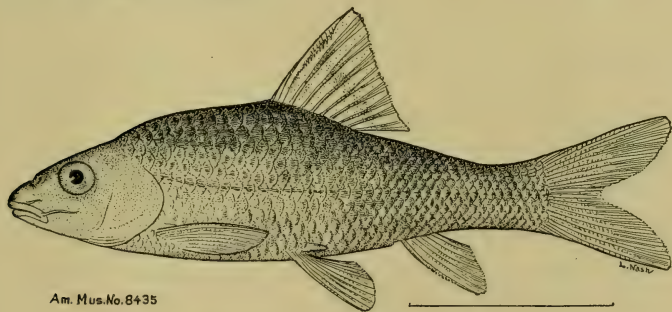


Fig. 4. *Barbus hemispinus*, type.

***Barbus hemispinus** NICHOLS, 1925, Amer. Mus. Novitates, No. 185, p. 2. Fukien.

CYCLOCHEILICHTHYS Bleeker

BLEEKER, 1859-60, Nat. Tijds. Ned.-Ind., p. 431. Type: *Cyclocheilichthys armatus* Bleeker.

***Cyclocheilichthys iridescens** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 347, Fig. 17. Hainan.

Cyclocheilichthys sinensis BLEEKER, 1879, 'Inedites Poiss. Chin.,' Verh. Akad. Amst., XVIII, p. 10, Pl. I, fig. 2. China.

CROSSOCHEILUS Van Hasselt

VAN HASSELT, 1823, Allg. Konst. Lett., II, p. 132. Type: *Hampala macrolepidota* Van Hasselt.

Crossocheilus monticola GÜNTHER,

Crossochilus monticola GÜNTHER, 1858, Ann. Mag. Nat. Hist., (6) I, p. 431.

Ichang gorge of the Yangtze.

Crossocheilus styani BOULENGER.

Crossochilus styani BOULENGER, 1901, Proc. Zool. Soc., London, pt. 1, p. 268. Pl. XXIII, fig. 1. Ningpo.

SINIBARBUS Sauvage

SAUVAGE, 1874, Rev. Mag. Zool. (Paris), II, p. 335. Type: *S. vittatus* Sauvage.

Sinibarbus vittatus SAUVAGE, 1874, Rev. Mag. Zool. (Paris), II, p. 335. Western Tchekiang.

DANIO Hamilton-Buchanan

HAMILTON-BUCHANAN, 1822, 'Fishes in Ganges,' p. 390. Type: *Cyprinus dangila* Hamilton-Buchanan.

Danio kakhienensis ANDERSON, 1878, 'Expeditions to Western Yunnan,' p. 868, Pl. LXXIX, fig. 2. Western Yunnan border (Nampoung River).

SCHIZOTHORAX Heckel

HECKEL, 1838, 'Fische Caschmir, etc.,' p. 11. Type: *Schizothorax plagiostomus* Heckel.

(SCHIZOTHORAX) Heckel

HECKEL, 1838, 'Fische Caschmir, etc.,' p. 11. Type: *Schizothorax plagiostomus* Heckel.

Schizothorax taliensis REGAN, 1907, Ann. Mag. Nat. Hist., XIX, p. 63. Yunnan.

Schizothorax yunnanensis NORMAN, 1923, Ann. Mag. Nat. Hist., (9) XI, p. 561. Yunnan.

Schizothorax potanini HERZENSTEIN, 1888, 'Prezewalski Cent. As. Reisen,' Zool., III, pt. 2, p. 134, Pl. XVI, fig. 1. Lun-ang-fu (western Yunnan border.)

(OREINUS) McClelland

MCCLELLAND, 1839, Ind. Cyp., As. Res., XIX, p. 273. Type: *Oreinus guttatus* McClelland.

***Schizothorax sinensis** HERZENSTEIN, 1889, 'Wiss. Res. Prezewalski Reis., Zool.,' III, pt. 2, p. 175, Pl. XX, fig. 2. Lun-ang-Fu.

Specimen examined from Wuting Chou District (Yunnan).

Schizothorax grahami (REGAN).

Oreinus grahami REGAN, 1904, Ann. Mag. Nat. Hist., (7) XIV, p. 416. Yunnan.

Schizothorax progastus (MCCLELLAND).

Oreinus progastus MCCLELLAND, 1839, Ind. Cyp. As. Res., XIX, pt. 2, pp. 274, 343, Pl. XL, fig. 4.

Yunnan (Chaudhuri).

SCHIZOPYGOPSIS Steindachner

STEINDACHNER, 1866, Verh. Zool. Bot. Ges. Wien, XVI, p. 786. Type: *Schizopygopsis stoliczkae* Steindachner.

Schizopygopsis pylzovi KESSLER, 1876, in Prejevalski's 'Mongolia,' II, pt. 4, p. 13. Kansu.

DIPTYCHUS Steindachner

STEINDACHNER, 1866, Verh. Zool.-Bot. Ges. Wien, XVI, p. 787. Type: *Diptychus maculatus* Steindachner.

Diptychus crassilabris STEINDACHNER, 1890, 'Reise Szechenyi Ostasien,' II, p. 508. Sining-fu.

LEUCISCUS Cuvier

CUVIER, 1817, 'Règne Animal,' II, p. 194. Type: *Cyprinus leuciscus* Linnæus.

Leuciscus waleckii (DYBOWSKI).

Idus waleckii DYBOWSKI, 1869, Verh. Zool. Bot. Ges. Wien, XIX, p. 593, Pl. XVI, fig. 5. Transbaikalia.

***Leuciscus waleckii sinensis** (Lönnberg).

Idus waleckii sinensis Lönnberg, 1925, Fauna och Flora (Upsala), 1925, pp. 196-197. Hoangho, Ping-lu-hsien, Shansi; also Honan.

Specimens examined from Yellow River at Paotou, Mongolia.

***Leuciscus waleckii waleckii** (Dybowski).

Idus waleckii DYBOWSKI, 1869, Verh. Zool.-Bot. Ges. Wien, XIX, p. 593, Pl. XVI, fig. 5. Transbaikalia.

Specimens examined from Shansi.

PHOXINUS Rafinesque

RAFINESQUE, 1820, 'Ichthyologia Ohienis,' p. 45. Type: *Cyprinus phoxinus* Linnæus. Europe.

Phoxinus lagowskii DYBOWSKI, 1869, Verh. Zool.-Bot., Ges. Wien, XIX, p. 952, Pl. xv, fig. 4. Amur River.

***Phoxinus lagowskii costatus** (FOWLER).

Leuciscus costatus FOWLER, 1899, Proc. Acad. Phila., LI, p. 180. Sungari basin, eastern Mongolia.

Probable habitat: Chihli (Fowler), northern Shansi and eastern Mongolia, southwest to western Szechwan.

***Phoxinus lagowskii variegatus** (GÜNTHER).

Rhyncocypris variegata GÜNTHER, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 225. Middle Yangtze.

Probable habitat: Chihli and Shansi south to the middle Yangtze, Hupeh and Kiangsi

ASPIUS Agassiz

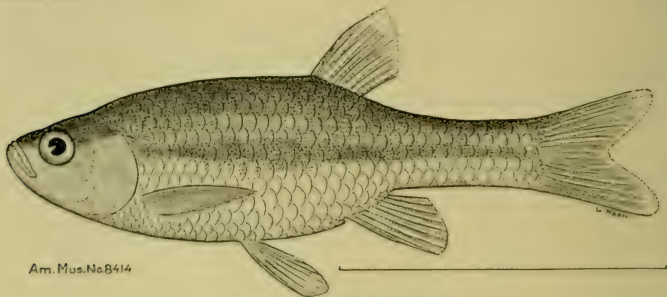
AGASSIZ, 1835, Mem. Soc. Sci. Nat. Neuchâtel, I, p. 38. Type: *Cyprinus rapax* Pallas = *Cyprinus aspius* Linnæus.

Aspius spilurus GÜNTHER, 1868, 'Cat.,' VII, p. 311. Inland mountainous region of Hongkong.

CARASPIUS Nichols

NICHOLS, 1925, Amer. Mus. Novitates, No. 177, p. 6. Type: *Caraspius agilis* Nichols.

**Caraspius agilis* NICHOLS, 1925, Amer. Mus. Novitates, No. 177, p. 6. Szechwan.



Am. Mus. No. 8414

Fig. 5. *Caraspius agilis*, type.

MYLOLEUCISCUS Garman

GARMAN, 1912, Mem. Mus. Comp. Zool., XL, p. 116. Type: *Myloleuciscus atripinnis* Garman = *Leuciscus æthiops* Basilewski.

**Myloleuciscus æthiops* (BASILEWSKI).

Leuciscus æthiops BASILEWSKI, 1855, N. Mem. Nat. Mosc., p. 233, Pl. vi, fig. 1. North China.

Peking, Chihli, Yangtze, N. China (Gee). Yangtze at Hankau (Kreyenberg and Pappenheim). Specimens examined from Tungting Lake (Hunan).

CTENOPHARYNGODON Steindachner

STEINDACHNER, 1866, Verh. Zool. bot. Gesell. Wein, XVI, p. 782. Type: *Ctenopharyngodon laticeps* Steindachner = *Leuciscus idella* Cuvier and Valenciennes.

**Ctenopharyngodon idella* (CUVIER AND VALENCIENNES).

Leuciscus idella CUVIER AND VALENCIENNES, 1844, 'Hist. Nat. Poiss.,' XVII, p. 362. China.

Ningpo, Shanghai (Gee). Specimens examined from Tungting Lake (Hunan), and from near Canton.

SQUALIOBARBUS Günther

GÜNTHER, 1868, 'Cat.,' VII, p. 297. Type: *Leuciscus curriculus* Richardson.

**Squaliobarbus curriculus* (RICHARDSON).

Leuciscus curriculus RICHARDSON, 1846, Rep. XV Meet. Brit. Assoc. (1845), p. 299. Canton.

N. China (Gee). Yangtze at Hankau (Kreyenberg and Pappenheim). Specimens examined from Shansi, Tungting Lake (Hunan), Fukien.

OCHETOBIOUS Günther

GÜNTHER, 1868, 'Cat.,' VII, p. 297. Type: *Opsarius* (?) *elongatus* Kner.

***Ochetobius elongatus** (KNER).

Opsarius (?) *elongatus* KNER, "'Novara," Fische,' p. 358, Pl. xv, fig. 1, Shanghai. Specimens examined from Tungting Lake (Hunan), Anhwei.

BARILIUS Hamilton-Buchanan

HAMILTON-BUCHANAN, 1822, 'Fishes in Ganges,' p. 384. Type: *Cyprinus barila* Hamilton-Buchanan.

Barilius alburnops REGAN, 1914, Ann. Mag. Nat. Hist., (8) XIII, p. 260. Yunnan.

Barilius andersoni REGAN, 1904, Ann. Mag. Nat. Hist., (7) XIV, p. 416. Yunnan.

Barilius grahami REGAN, 1908, Ann. Mag. Nat. Hist., (8) II, p. 357. Yunnan.

Barilius hainanensis BOULENGER, 1899, Proc. Zool. Soc. London, pt. 2, p. 961, Pl. LXIX, fig. 2. Hainan.

Barilius polylepis REGAN, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 191. Yunnan.

Barilius interrupta DAY, 1869, Proc. Zool. Soc., p. 559. Hotha, Yunnan (Anderson).

ELOPICHTHYS Bleeker

BLEEKER, 1859, Nat. Tijd. Ned.-Ind., XX, p. 436. Type: *Leuciscus bambusa* Richardson.

Elopichthys bambusa (RICHARDSON).

Leuciscus bambusa RICHARDSON, 1844, 'Voy. "Sulph.," Ichth.,' p. 141. Pl. LXIII, fig. 2. (Canton); and 'Ichth. Chin.,' p. 299.

Ningpo, Canton, Shanghai, Pei Ho, Tientsin (Gee). Yangtze at Hankau (Kreyenberg and Pappenheim).

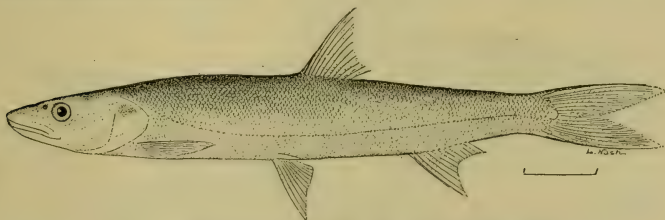


Fig. 6. *Scombrocypris styani*, 198 mm. standard length.

SCOMBROCYPRIS Günther

GÜNTHER, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 226. Type: *Scombrocypris styani* Günther.

***Scombrocypris styani** GÜNTHER, 1889, Ann. Mag. Nat. Hist., (6) VI, p. 226. Yangtze.

Specimen examined from Tungting Lake (Hunan).

RASBORA Bleeker

BLEEKER, 1859, Consp. Syst. Cypr., Nat. Tijds. Neder.-Ind., XX, p. 435. Type: *Cyprinus rasbora* Hamilton-Buchanan.

Rasbora cephalotænia (BLEEKER).

Leuciscus cephalotænia Bleeker, 1852, Nat. Tijds. Ned.-Ind., III, p. 97. Billiton, East Indies.

***Rasbora cephalotænia steineri** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 364, Fig. 30. Hainan.

OPSARIICHTHYS Bleeker

BLEEKER, 1863, Ned. Tijds. Dierk., I, p. 203. Type: *Leuciscus uncirostris* Temminck and Schlegel.

***Opsariichthys minutus** NICHOLS, 1926, Amer. Mus. Novitates, No. 224, p. 6, Fig. 5. Fukien.

***Opsariichthys bidens** GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 249. Shanghai.

Specimens examined from Shansi, Anhwei, Fukien, Szechwan.

Opsariichthys uncirostris (TEMMINCK AND SCHLEGEL).

Leuciscus uncirostris TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 211, Pl. CII, fig. 2. Japan.

Chihli (Fowler, 1924).

Opsariichthys acanthogenys BOULENGER, 1901, Proc. Zool. Soc., pt. 1, p. 269, Pl. XXIV, fig. 1, Ningpo. [This is probably a *Zacco*.]

***Opsariichthys hainanensis** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 368, Fig. 33. Hainan.

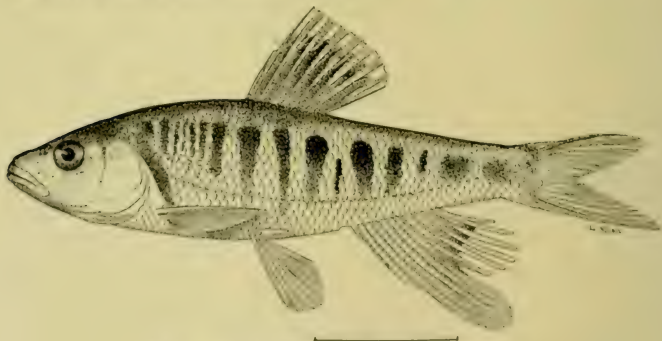
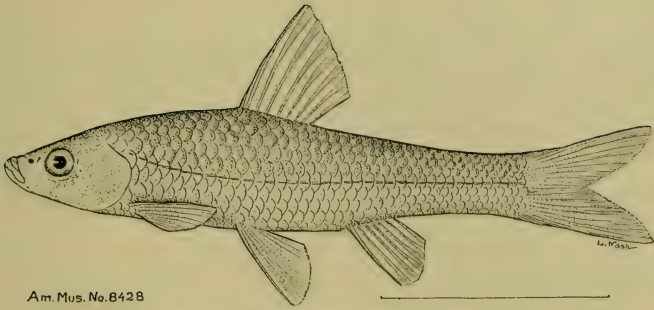


Fig. 7. *Zacco platypus*, from Fukien Province.

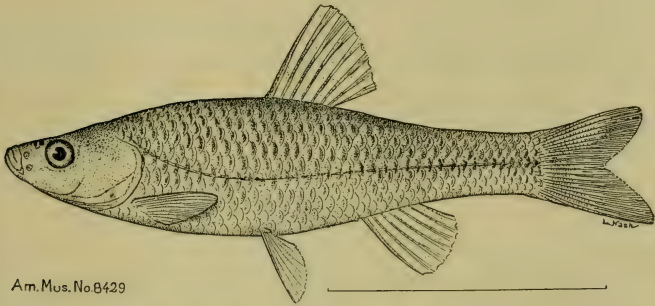
ZACCO Jordan and Evermann

JORDAN AND EVERMANN, 1902, Proc. U. S. Nat. Mus., XXV, p. 322. Type: *Leuciscus platypus* Temminck and Schlegel.



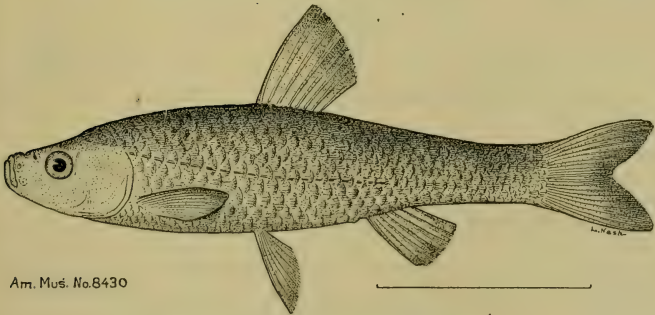
Am. Mus. No. 8428

Fig. 8. *Pseudorasbora altipinna*, type.



Am. Mus. No. 8429

Fig. 9. *Pseudorasbora depressirostris*, type.



Am. Mus. No. 8430

Fig. 10. *Pseudorasbora monstrosa*, type.

***Zacco asperus** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 367, Fig. 32. Hainan.

***Zacco platypus** (TEMMINCK AND SCHLEGEL).

Leuciscus platypus TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 207, Pl. ci, fig. 1. Japan.

Yangtze at Nankaiho (Kreyenberg and Pappenheim). Specimens examined from Chihli, Fukien.

PSEUDORASBORA Bleeker

BLEEKER, 1859, Nat. Tijd. Ned.-Ind., XX, p. 435. Type: *Leuciscus parvus* Temminck and Schlegel.

***Pseudorasbora parva** (TEMMINCK AND SCHLEGEL).

Leuciscus parvus TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 215, Pl. cii, fig. 3. Japan.

Chihli (Fowler, 1924).

***Pseudorasbora altipinna** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 5. Szechwan.

***Pseudorasbora depressirostris** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 5. Shansi.

***Pseudorasbora fowleri** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 5. Anhwei.

Specimens examined from Anhwei.

***Pseudorasbora monstrosa** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 6. Fukien.

LUCIOBRAMA Bleeker

BLEEKER, 1870, Versl. Akad. Amst., (2) IV, p. 253. Type: *Luciobrama typus* Bleeker.

***Luciobrama typus** BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 51, Pl. i, fig. 2. Yangtze?

Specimens examined from Tungting Lake (Hunan.)

SEMILABEO Peters

PETERS, 1880, Monath. Akad. Wiss. Berl., p. 1032. Type: *Semilabeo notabilis* Peters.

Semilabeo notabilis PETERS, 1880, Monath. Akad. Wiss. Berl., p. 1032, Fig. 3. Hongkong.

LABEO Cuvier

CUVIER, 1817, 'Règne Animal,' II, p. 194. Type: *Cyprinus niloticus* (Forskål) Geoffroy.

Labeo yunnanensis CHAUDHURI, 1911, Rec. Ind. Mus., VI, p. 14, Pl. i, figs. 1, 1a, 1b. Yunnan.

Labeo decorus PETERS, 1880, Monath. Akad. Wiss. Berl., p. 1031, Fig. 2. Hongkong.

***Labeo jordani** OSHIMA, 1919, Ann. Carn. Mus., XII, p. 204, Pl. XLIX, fig. 3. Formosa.

Specimen examined from Swatow.

***Labeo collaris** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 362, Fig. 28. Hainan.

TYLOGNATHUS Heckel

HECKEL, 1842, 'Ich., Syrien, Russegger Reisen, etc.,' I, p. 1073. Type: *Tylognathus diplostomus* Heckel.

Tylognathus davidi SAUVAGE, 1878, Bull. Soc. Phil. Paris, II, p. 86. Western Szechwan.

GARRA Hamilton-Buchanan

HAMILTON-BUCHANAN, 1822, 'Fishes in Ganges,' p. 393. Type: *Cyprinus lamta* Hamilton-Buchanan.

(**GARRA**) Hamilton-Buchanan

HAMILTON-BUCHANAN, 1822, 'Fishes in Ganges,' p. 393. Type: *Cyprinus lamta* Hamilton-Buchanan.

Garra yunnanensis (REGAN).

Discognathus yunnanensis REGAN, 1907, Ann. Mag. Nat. Hist., (7) XIX, p. 63. Yunnan.

Garra prochilus (SAUVAGE AND DABRY DE THIERSANT).

Discognathus prochilus SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., (6) I, No. 5, p. 8. Szechwan.

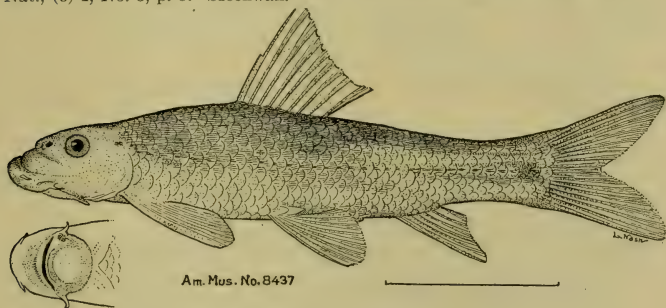


Fig. 11. *Garra orientalis*, type.

***Garra orientalis** NICHOLS, 1925, Am. Mus. Novitates, No. 185, p. 4. Fukien.

***Garra schismatorhyncha** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 358, Fig. 25. Hainan.

(**AGENEIOGARRA**) Garman

GARMAN, 1912, Mem. Mus. Comp. Zool., XL, p. 114. Type: *Garra imberba* Garman.

Garra imberbis (VINCIGUERRA).

Discognathus imberbis VINCIGUERRA, 1890, Ann. Mus. Genov., (2) IX, p. 277, Pl. IX, fig. 7. Burma.

Hainan (Boulenger, 1899).

Garra imberba GARMAN.

Garra (Ageniogarra) imberba GARMAN, 1912, Mem. Mus. Comp. Zoöl., XL, p. 114. Western Szechwan. Preoccupied by *Discognathus imberbis* Vinciguerra (?).

VARICORHINUS Rüppell

RÜPPELL, 1836, Museum Senckenberg, II, p. 14. Type: *Varicorhinus beso* Rüppell = *Labeo varicorhinus* Cuvier and Valenciennes.

***Varicorhinus discognathoides** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 360, Fig. 26. Hainan.

Varicorhinus kreyenbergii (REGAN).

Gymnostomus kreyenbergii REGAN, 1908, Ann. Mag. Nat. Hist., (S) I, p. 109, Fig. a, Pl. IV, fig. 1. Nankancho near Tinghsiang (probably in Kiangsi).

Yangtze (Nankanho at Pinghsiang) (Kreyenberg and Pappenheim).

Varicorhinus macrolepis (BLEEKER).

Gymnostomus macrolepis BLEEKER, 1871, Verh. Akad. Amst., Nat., XII, p. 32, Pl. VIII, fig. 2. Yangtze?

***Varicorhinus tamusuiensis** (OSHIMA).

Scaphesthes tamusuiensis OSHIMA, 1919, Ann. Carn. Mus., XII, p. 209, Pl. L, fig. 1. Formosa.

Specimens examined from Fukien.

***Varicorhinus robustus** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 2. Fukien.

***Varicorhinus shansiensis** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 2. Shansi.

***Varicorhinus tungting** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 3. Tungting Lake.

ONYCHOSTOMA Günther

GÜNTHER, 1896, Ann. Mus. Zoöl. St. P., pt. 1, p. 211. Type: *O. laticeps* Günther.

Onychostoma laticeps GÜNTHER, 1896, Ann. Mus. Zool. St. P., pt. 1, p. 211, Pl. I, fig. b. Near Hui-hsien, Kansu.

Onychostoma gerlachi (PETERS).

Barbus gerlachi PETERS, 1880, Monatb. Akad. Wiss. Berl., p. 1034, Fig. 5. Hong-kong.

***Onychostoma leptura** (BOULENGER).

Gymnostomus lepturus BOULENGER, 1899, Proc. Zoöl. Soc. London, pt. 2, p. 961. Hainan.

Specimens examined from Hainan.

XENOCYPRIS Günther

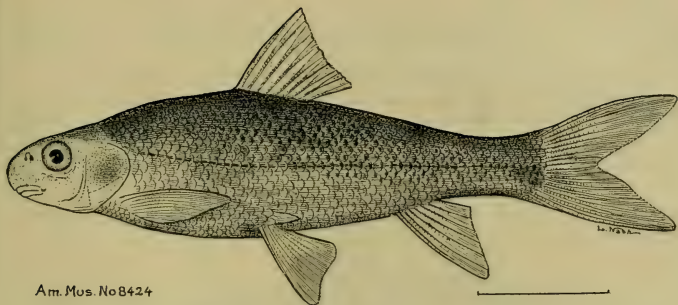
GÜNTHER, 1868, 'Cat.,' VII, p. 205. Type: *Xenocypris argentea* Günther.

(XENOCYPRIS) Günther

GÜNTHER, 1868, 'Cat.,' VII, p. 205. Type: *Xenocypris argentea* Günther.

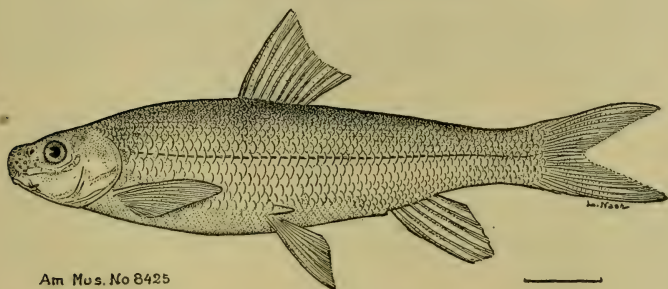
Xenocypris argentea GÜNTHER, 1868, 'Cat.,' VII, p. 205. China.

***Xenocypris davidi** BLEEKER, 1871, Verh. Akad. Wet., Amst., Nat., XII, p. 56. Yangtze?



Am. Mus. No 8424

Fig. 12. *Varicorhinus robustus*, type.



Am Mus. No 8425

Fig. 13. *Varicorhinus shansiensis*, type.



Am. Mus. No 8426



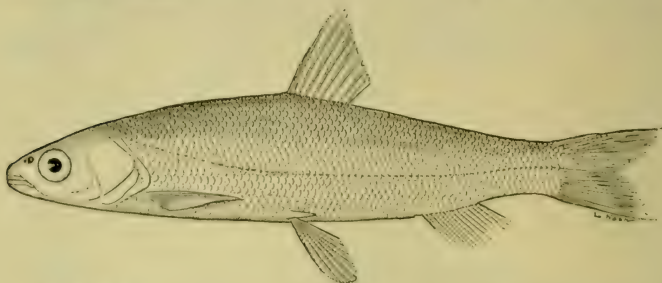
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Fig. 14. *Varicorhinus tungting*, type.

Specimens examined from Shansi, Tungting Lake (Hunan), Anhwei.

***Xenocypris insularis** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 363, Fig. 29. Hainan.

Xenocypris lampertii POPTA, 1908, Zool. Anz., XXXII, p. 243. Kiantsehou (?southwest of Canton).



Am. Mus. No. 8440

Fig. 15. *Xenocypris yunnanensis*, type.

Xenocypris macrolepis BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 53, Pl. v, fig. 2. Yangtze.

***Xenocypris yunnanensis** NICHOLS, 1925, Amer. Mus. Novitates, No. 185, p. 6. Yunnan.

(PLAGIOGNATHOPS) Berg

BERG, 1907, Ann. Mus. Zool. St. P., XII, p. 419. Type: *Xenocypris microlepis* Bleeker.

Xenocypris microlepis BLEEKER, 1871, 'Mem. Cypr. Chin.,' p. 58, Pl. ix. Yangtze.

Tungting (Kreyenberg and Pappenheim).

(DISTOECHODON) Peters

PETERS, 1880, Monatb. Akad. Wiss. Berl., p. 924. Type: *Distoechodon tumirostris* Peters.

Xenocypris tumirostris (PETERS).

Distoechodon tumirostris PETERS, 1880, Monatb. Akad. Wiss. Berl., p. 924. Ningpo.

***Xenocypris compressus** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 4. Fukien.

PARACANTHOBRAMA Bleeker

BLEEKER, 1865, Ned. Tijds. Dierk., II, p. 23. Type: *Paracanthobrama guichenoti* Bleeker.

Paracanthobrama guichenoti BLEEKER, 1864, Ned. Tijds. Dierk., p. 24. China.

ACANTHOBRAMA Heckel

HECKEL, 1842, 'Ich. Russ., Reisen, etc.,' pt. 1, p. 1033. Type: *Acanthobrama marmid* Heckel.

**Acanthobrama dumerili* (Bleeker).

Pseudobrama dumerili BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 60, Pl. VII, fig. 1. Yangtze?

Specimens examined from Anhwei.

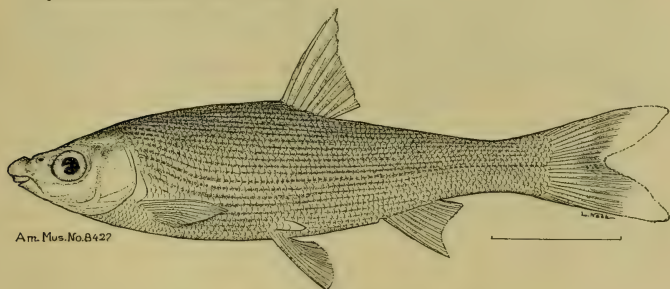


Fig. 16. *Xenocypris compressus*, type.

**Acanthobrama simoni* BLEEKER, 1865, Ned. Tijds. Dierk., II, p. 25. China. Specimens examined from Tungting Lake (Hunan).

CULTICULA Abbott

ABBOTT, 1901, Proc. U. S. Nat. Mus., XXIII, p. 485. Type: *Culticula emmelas* Abbott.

Culticula emmelas ABBOTT, 1901, Proc. U. S. Nat. Mus., XXIII, p. 485, Fig. Chihli.

APHYOCYPRIS Günther

GÜNTHER, 1868, 'Cat.' VII, p. 201. Type: *Aphyocypris chinensis* Günther.

**Aphyocypris chinensis* GÜNTHER, 1868, 'Cat.,' VII, p. 201. Chikiang.

Tji-kiang (Gee). Specimen examined from S. Hupeh (by courtesy of the British Museum).

**Aphyocypris kikuchii* (OSHIMA).

Phoxiscus kikuchii Oshima, 1919, Ann. Carn. Mus., XII, p. 226, Pl. LI, fig. 3. Formosa.

Specimen examined from Fukien.

**Aphyocypris normalis* NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 376. Fig. 39. Hainan.

HYPOPHTHALMICHTHYS Bleeker

BLEEKER, 1860, Ich. Arch. Ind. Prodr., II, Cypr., p. 283, 405. Type: *Leuciscus molitrix* Cuvier and Valenciennes.

Hypophthalmichthys microlepis (STEINDACHNER).

Abramoccephalus microlepis STEINDACHNER, 1869, Sitz.-ber. Akad. Wiss. Wien, LX, p. 302. China.

***Hypophthalmichthys molitrix** (CUVIER AND VALENCIENNES).

Leuciscus molitrix CUVIER AND VALENCIENNES, 1844, 'Hist. Nat. Poiss.,' XVII, p. 360. China.

Ningpo, Yangtze (Gee). Specimens examined from Tungting Lake (Hunan).

***Hypophthalmichthys nobilis** (RICHARDSON).

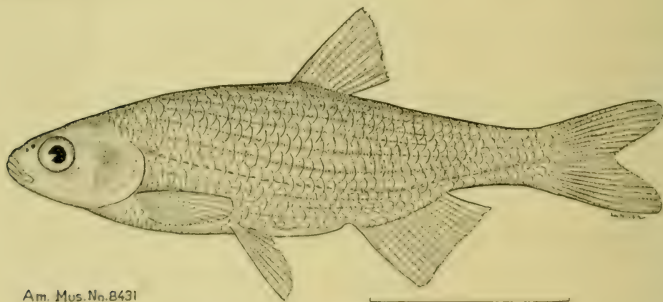
Leuciscus nobilis RICHARDSON, 1844, 'Voy. "Sulph.," Ichth.,' p. 140, Pl. LXIII, fig. 3. Canton; and 'Ichth. Chin.,' p. 295; attributed to Gray.

Ningpo, Shanghai, Yangtze (Gee). Yangtze at Hankau (Kreyenberg and Pappenheim). Specimens examined from near Canton.

RASBORINUS Oshima

OSHIMA, 1920, Proc. Acad. Phila., LXXII, p. 130. Type: *Rasborinus takakii* Oshima.

***Rasborinus fukiensis** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 6. Fukien.



Am. Mus. No. 8431

Fig. 17. *Rasborinus fukiensis*, type.

***Rasborinus hainanensis** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 377, Fig. 40. Hainan.

HEMICULTERELLA Warpachowski

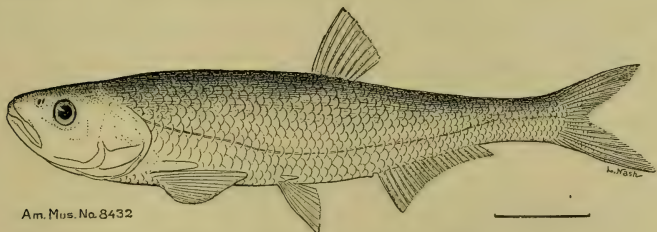
WARPACHOWSKI, 1888, Bull. Acad. Sci. St. P., XXXII, pp. 17-23. Type: *Hemiculterella sauvagei* Warpachowski.

Hemiculterella sauvagei WARPACHOWSKI, 1888, Bull. Acad. Sci. St. P., XXXII, p. 23. Western Szechwan.

***Hemiculterella engraulis** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 7. Tungting Lake.

HEMICULTER Bleeker

BLEEKER, 1859, Nat. Tijds. Ned.-Ind., XX, p. 432. Type: *Culter leucisculus* Basilewski.



Am. Mus. No. 8432

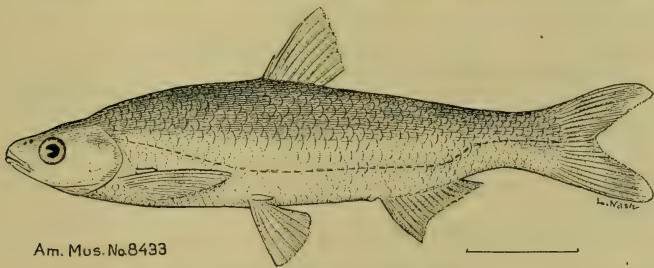
Fig. 18. *Hemiculterella engraulis*, type.**(HEMICULTER)** Bleeker

BLEEKER, 1859, Nat. Tijds. Ned.-Ind., XX, p. 432. Type: *Culter leucisculus* Basilewski.

***Hemiculter leucisculus** (BASILEWSKI).

Culter leucisculus BASILEWSKI, 1855, N. Mem. Soc. Nat. Mosc., X, p. 238. North China.

Shanghai, Chihli Prov., Yangtze (Gee). Specimens examined from Shansi.



Am. Mus. No. 8433

Fig. 19. *Hemiculter clupeoides*, type.

***Hemiculter schrencki** WARPACHOWSKI, 1888, Bull. Acad. Sci. St. P., XXXII, p. 18. Fu-tschau.

Specimens examined from Fukien.

***Hemiculter kneri** WARPACHOWSKI, 1888, Bull. Acad. Sci. St. P., XXXII, p. 18. Shanghai.

Specimens examined from Anhwei.

***Hemiculter clupeoides** NICHOLS, 1925, Amer. Mus. Novitates, No. 182, p. 7. Tungting Lake.

(PSEUDOHemiculter) Nichols and Pope

NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 372. Type: *Hemiculter hainanensis* Nichols and Pope.

***Hemiculter hainanensis** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 372, Fig. 36. Hainan.

***Hemiculter dispar** PETERS, 1880, Monatsb. Akad. Wiss. Berlin, p. 1035, Fig. 7. Hongkong.

Specimens examined from Fukien.

***Hemiculter serracanthus** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 373, Fig. 37. Hainan.

TOXABRAMIS Günther

GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 249. Type: *Toxabramis swinhonis* Günther.

Toxabramis argentifer ABBOTT, 1901, Proc. Nat. Mus., XXIII, p. 484, Fig. Chihli.

Toxabramis swinhonis GÜNTHER, 1873, Ann. Mag. Nat. Hist., XII, p. 250. Shanghai.

PARAPELECUS Günther

GÜNTHER, 1889, Ann. Mag. Nat. Hist., IV, p. 227. Type: *Parapelecus argenteus* Günther.

Parapelecus argenteus GÜNTHER, 1889, Ann. Mag. Nat. Hist., IV, p. 227. Kiangsi.

***Parapelecus fukiensis** NICHOLS, 1926, Amer. Mus. Novitates, No. 224, p. 7, Fig. 6. Fukien.

Parapelecus machaerius ABBOTT, 1901, Proc. Nat. Mus., XXIII, p. 488, Fig. Chihli.

***Parapelecus nicholsi** (FOWLER).

Chela nicholsi FOWLER, 1923, Amer. Mus. Novitates, No. 83, p. 1. Anhwei.

Specimens examined from Anhwei.

PSEUDOLAUBUCA Bleeker

BLEEKER, 1864, Ned. Tijds. Dierk., II, p. 28. Type: *Pseudolaubuca sinensis* Bleeker.

Pseudolaubuca sinensis BLEEKER, 1864, Ned. Tijds. Dierk., II, p. 29. China.

ISCHIKAUIA Jordan and Snyder

JORDAN AND SNYDER, 1900, Proc. U. S. Nat. Mus., XXIII, p. 346. Type: *Opsariichthys steenackeri* Sauvage.

***Ischikauia andrewsi** (NICHOLS).

Hemiculter andrewsi NICHOLS, 1918, Proc. Biol. Soc. Wash., XXXI, p. 17. Yunnan.

***Ischikauia hainanensis** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 374, Fig. 38. Hainan.

***Ischikauia transmontana** NICHOLS, 1925, Amer. Mus. Novitates, No. 185, p. 7. Yunnan.

ERYTHROCULTER Berg

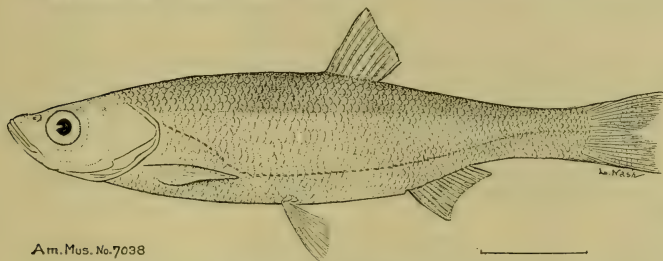
BERG, 1909, Mem. Acad. Sci. St. P., (8) XXIV, No. 4, p. 138. Type: *Culter erythropterus* Basilewski.

***Erythroculter erythropterus** (BASILEWSKI).

Culter erythropterus BASILEWSKI, 1855, N. Mem. Soc. Nat. Mosc., X, p. 236, Pl. VIII, fig. 1. North China.

Chihli, North China (Gee). Specimen examined from Tungting Lake (Hunan).

***Erythroculter mongolicus** (Basilewski).



Am. Mus. No. 7038

Fig. 20. *Ischikauia andrewsi*, type.



Am. Mus. No. 8441

Fig. 21. *Ischikauia transmontana*, type.

Culter mongolicus BASILEWSKI, 1855, M. Mem. Soc. Nat. Mosc., X, p. 237. North China.

Specimens examined from Tungting Lake (Hunan).

***Erythroculter recurviceps** (RICHARDSON).

Leuciscus recurviceps RICHARDSON, 1845, 'Ich. Chin.,' p. 295. Canton.

Shanghai, Chihli, Canton (Gee). Specimens examined from Tungting Lake (Hunan).

Erythroculter oxycephalus (BLEEKER).

Culter oxycephalus BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 74, Pl. v, fig. 3. Yangtze.

***Erythroculter oxycephaloides** (KREYENBERG AND PAPPENHEIM).

Culter oxycephaloides KREYENBERG AND PAPPENHEIM, 1908, Sitzb. Ges. Nat. Fr. Berl., p. 104. Yangtze basin.

Specimens examined from Tungting Lake (Hunan).

***Erythroculter aokii** (OSHIMA).

Culter aokii OSHIMA, 1919, Ann. Carn. Mus., XII, p. 250, Pl. LII, fig. 1. Formosa. Specimen examined from Fukien.

***Erythroculter pseudobrevicauda** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 371, Fig. 35, Hainan.

CULTER Basilewski

BASILEWSKI, 1855, Nouv. Mem. Soc. Nat. Moscou, X, p. 236. Type: *Culter alburnus* Basilewski.

Culter alburnus BASILEWSKI, 1855, Nouv. Mem. Soc. Nat. Moscou, X, p. 236, Pl. VIII, fig. 3. North China.

***Culter brevicauda** GÜNTHER, 1868, 'Cat.,' VII, p. 329. Formosa.

Shanghai, Yangtze (Gee). Hainan (Oshima). Specimens examined from Anhwei.

Culter tientsinensis ABBOTT, 1901, Proc. U. S. Nat. Mus., XXIII, p. 489, Fig. Chihli.

CHANODICHTHYS Bleeker

BLEEKER, 1860, 'Prodr. Cypr.,' p. 400. Type: *Leptocephalus mongolicus* Basilewski.

Chanodichthys mongolicus (BASILEWSKI).

Leptocephalus mongolicus BASILEWSKI, 1855, Nouv. Mem. Soc. Nat. Mosc., X, p. 234, Pl. IV, fig. 2. North China.

MEGALOBAMA Dybowski

DYBOWSKI, 1872, Verh. Zool.-Bot. Gesell. Wien, XXII, p. 212. Type: *Megalobrama skolkovii* Dybowski = *Chanodichthys terminalis* (Richardson).

***Megalobrama macrops** (GÜNTHER).

Chanodichthys macrops GÜNTHER, 1868, 'Cat.,' VII, p. 326. Formosa.

Specimens examined from Fukien.

***Megalobrama melrosei** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 369, Fig. 34. Hainan.

***Megalobrama terminalis** (RICHARDSON).

Abramis terminalis RICHARDSON, 1846, Rept. XV Meet. Brit. Assoc., p. 294. Canton.

Specimens examined from Fukien.

Megalobrama bramula (Cuvier and Valenciennes).

Leuciscus bramula CUVIER AND VALENCIENNES, 'Hist. Nat. Poiss.,' XVII, p. 357. Chinese painting.

Ningpo, Yangtze, Canton (Gee). Specimens examined from Tungting Lake (Hunan), Anhwei.

PARABRAMIS Bleeker

BLEEKER, 1865, Ned. Tijd. Dierk., II, p. 21. Type: *Abramis pekinensis* Basilewski.

***Parabramis pekinensis** (BASILEWSKI).

Abramis pekinensis BASILEWSKI, 1855, N. Mem. Soc. Nat. Mosc., X, p. 238, Pl. VI, fig. 2. North China.

Chihli, Yangtze, N. China, Shanghai (Gee). Hainan (*Chanodichthys stenzi* Popta) (Oshima). Specimens examined from Tungting Lake (Hunan).

RHODEUS Agassiz

AGASSIZ, 1835, Mem. Soc. Nat. Neuf., I, p. 37. Type: *Cyprinus amarus* Bloch.

***Rhodeus maculatus** FOWLER, 1910, Proc. Acad. Phila., LXII, p. 476, Fig. Tien-tsin.

Specimens examined from Shansi, Anhwei, Fukien.

***Rhodeus sinensis** Günther, 1868, 'Cat.,' VII, p. 280. China.

Southern China (Berg). Specimens examined from Shansi; Shaohsing.

Rhodeus spinalis OSHIMA, 1926, Annot. Zool. Japon., XI, p. 16. Kachek River, Hainan.

PSEUDOPERILAMPUS Bleeker

BLEEKER, 1863, Ned. Tijds. Dierk., I, p. 214. Type: *Pseudoperilampus typus* Bleeker.

***Pseudoperilampus ocellatus** KNER.

Pseudoperilampus (?) *ocellatus* KNER, 1867, "Novara," Fische, p. 365, Pl. xv, fig. 6. Shanghai.

Shanghai, Yangtze (Berg). Yangtze at Pinghsiang (Kreyenberg and Pappenheim). Specimens examined from Anhwei; Szechwan; Fukien.

***Pseudoperilampus hainanensis** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 379, Fig. 42. Hainan.

PARACHEILOGNATHUS Bleeker

BLEEKER, 1863, Ned. Tijds. Dierk., I, p. 213. Type: *Capoeta rhombea* Temminck and Schlegel.

Paracheilognathus bleekeri BERG, 1907, Ann. Mag. Nat. Hist., (7) XIX, p. 162. Yangtze, Tientsin.

Paracheilognathus imberbis (GÜNTHER).

Achilognathus imberbis GÜNTHER, 1868, 'Cat.,' VII, p. 278. China.

Ningpo, Pei Ho, Tientsin (Gee).

Paracheilognathus peihoensis FOWLER, 1910, Proc. Acad. Phila., LXII, p. 481, Fig. 3. Tien-tsin. For *Acheilognathus imberbis* Abbott, not of Bleeker.

ACHEILOGNATHUS Bleeker

BLEEKER, 1859, Nat. Tijds. Ned.-Ind., XX, p. 427. Type: *Acheilognathus melanogaster* Bleeker.

***Acheilognathus gracilis** NICHOLS, 1926, Amer. Mus. Novitates, No. 214, p. 5, Fig. 5. Tungting Lake.

***Acheilognathus barbatus** GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 248. Shanghai.

Specimens examined from Anhwei.

***Acheilognathus barbatus** NICHOLS, 1926, Amer. Mus. Novitates, No. 214, p. 6, Fig. 6. Anhwei.

***Acheilognathus himantegus** GÜNTHER.

Achilognathus himantegus GÜNTHER, 1868, 'Cat.,' VII, p. 277. Formosa.

Specimens examined from Fukien.

ACANTHORHODEUS Bleeker

BLEEKER, 1870, Versl. Akad. Amst., (2) IV, p. 253. Type: *Acanthorhodeus macropterus* Bleeker.

Acanthorhodeus elongatus REGAN, 1908, Ann. Mag. Nat. Hist., (8) II, p. 356. Yunnan.

Acanthorhodeus dicæus RUTTER, 1898, Proc. Acad. Phila. for 1897, pp. 56-90. Swatow.

***Acanthorhodeus atranalis** GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 248. Shanghai.

Specimens examined from Shaohsing.

Acanthorhodeus hypselonotus BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 43, Pl. XI, fig. 2. Yangtze.

Hankau, Yangtze (Kreyenberg and Pappenheim).

Acanthorhodeus macropterus BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 40, Pl. II, fig. 2. Yangtze?.

Yangtze, Ningpo (Gee).

***Acanthorhodeus grahami** NICHOLS, 1918, Proc. Biol. Soc. Wash., XXXI, p. 18. Yunnan. [A synonym of *A. elongatus*.]

***Acanthorhodeus tænianalis** GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4), XII, p. 247. Shanghai.

Tungting (Kreyenberg and Pappenheim). Specimens examined from Shansi; Anhwei.

***Acanthorhodeus guichenoti** Bleeker, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 41, Pl. XIII, fig. 2. Yangtze.

Specimens examined from Tungting Lake (Hunan); Anhwei.

***Acanthorhodeus tonkinensis** VAILLANT, 1892, Bull. Soc. Phil. Paris, 1891-92, p. 127. Upper Tonking.

Specimens examined from Hainan.

HEMIBARBUS Bleeker

BLEEKER, 1859, 'Consp. Syst. Cyp.,' Nat. Tijd. Ned.-Ind., XX, p. 431. Type: *Gobio barbatus* Temminck and Schlegel.

Hemibarbus dissimilis BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 21, Pl. VI, fig. 1. Yangtze.

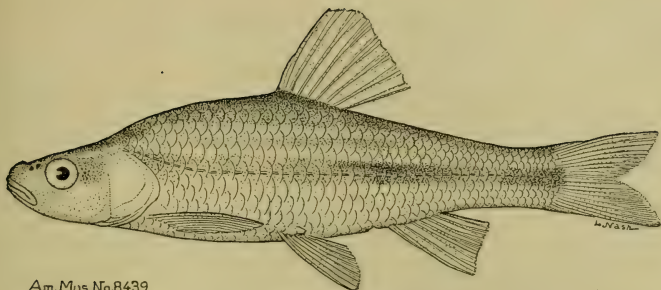
***Hemibarbus labeo** (PALLAS).

Cyprinus labeo PALLAS, 1776, 'Reise,' III, pp. 207, 703. Upper Amur River.

Chefoo (Gee). Specimens examined from Chihli, Tungting Lake (Hunan), Anhwei, Fukien, Hainan Island.

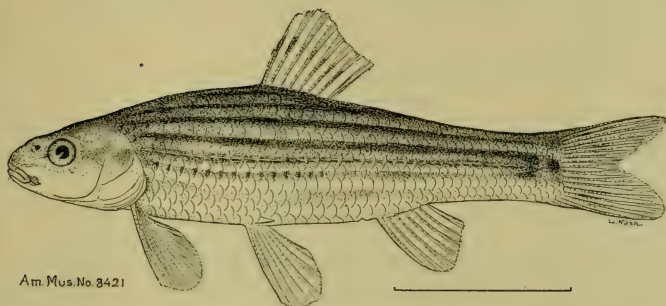
***Hemibarbus maculatus** BLEEKER, 1871, Verh. Akad. Amst., Nat., XII, p. 19, Pl. IV, fig. 3. Yangtze.

Specimens examined from Tungting Lake (Hunan).



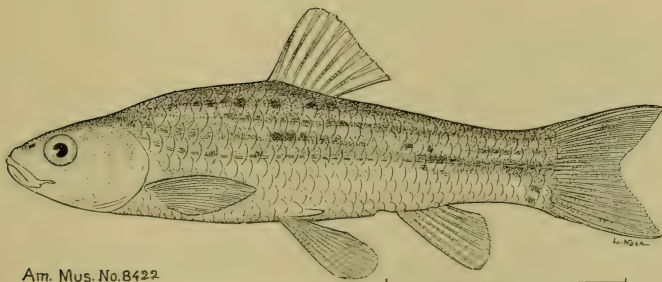
Am. Mus. No. 8439

Fig. 22. *Leucogobio imberbis*, type.



Am. Mus. No. 8421

Fig. 23. *Leucogobio polytania*, type.



Am. Mus. No. 8422

Fig. 24. *Leucogobio tæniellus*, type.

ACANTHOGOBIO Herzenstein

HERZENSTEIN, 1892, Mel. Biol., XIII, p. 228. Type: *Acanthogobio guentheri* Herzenstein.

Acanthogobio guentheri HERZENSTEIN, 1892, Mel. Biol., XIII, p. 228
Central Asia.

Southern Kansu (Günther).

LEUCOGOBIO Günther

GÜNTHER, 1896, Ann. Mus. Zool. St. P., I, p. 212. Type: *Leucogobio herzensteini* Günther.

(PARALEUCOGOBIO) Berg

BERG, 1907, Ann. Mag. Nat. Hist., (7) XIX, p. 163. Type: *Paraleucogobio notacanthus* Berg.

***Leucogobio notacanthus** (BERG).

Paraleucogobio notacanthus BERG, 1907, Ann. Mag. Nat. Hist., (7) XIX, p. 163.
N. E. of Pekin.

Specimens examined from Chihli.

(LEUCOGOBIO) Günther

GÜNTHER, 1896, Ann. Mus. Zool. St. P., I, p. 212. Type: *Leucogobio herzensteini* Günther.

Leucogobio herzensteini GÜNTHER, 1896, Ann. Mus. Zool., I, p. 213, Pl. II, fig. B. Southern Kansu.

***Leucogobio imberbis** NICHOLS, 1925, Amer. Mus. Novitates, No. 185, p. 6.
Anhwei.

***Leucogobio polytænia** NICHOLS, 1925, Amer. Mus. Novitates, No. 181, p. 6.
Shansi.

Leucogobio tæniatus GÜNTHER, 1896, Ann. Mus. Zool., I, p. 214, Pl. II, fig. A.
Headwaters of the Yangtze.

***Leucogobio tæniellus** NICHOLS, 1925, Amer. Mus. Novitates, No. 181, p. 7.
Fukien.

GNATHOPOGON Bleeker

BLEEKER, 1860, Nat. Tijds. Ned. Ind., XX, p. 435. Type: *Capoita elongata* Temminck and Schlegel.

***Gnathopogon argentatus** (SAUVAGE AND DABRY DE THIERSANT).

Gobio argentatus SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., (6) I, Art. 5, p. 9. Yangtze.

Specimens examined from Tungting Lake (Hunan).

***Gnathopogon atromaculatus** NICHOLS and POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 351. Hainan.

***Gnathopogon punctatus** NICHOLS, 1925, Amer. Mus. Novitates, No. 181, p. 7. Fukien.

***Gnathopogon wolterstorffi** (REGAN).

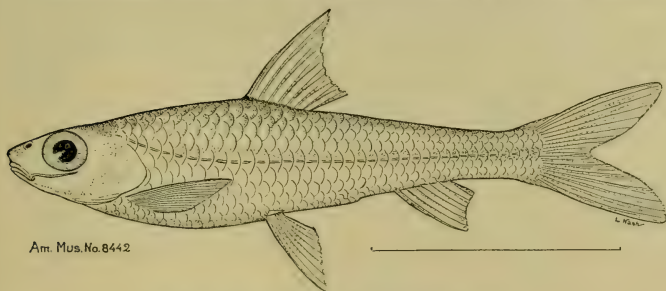
Gobio wolterstorffi REGAN, 1908, Ann. Mag. Nat. Hist., (8) I, p. 110, Pl. IV.
Nankanchow, near Tingsiang.

Specimens examined from Chihli.

Gobio Cuvier

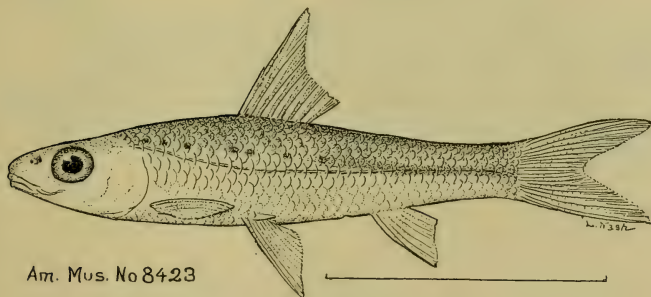
CUVIER, 1817, 'Règne Animal,' II, p. 193. Type: *Cyprinus gobio* Linnaeus.

Gobio nitens GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 246. Shanghai.



Am. Mus. No. 8442

Fig. 25. *Gnathopogon atromaculatus*, type.



Am. Mus. No. 8423

Fig. 26. *Gnathopogon punctatus*, type.

Gobio nummifer BOULENGER, 1901, Proc. Zool. Soc., pt. I, p. 269, Pl. xxiii, fig. 2. Ningpo.

Gobio soldatovi BERG.

Gobio gobio var. *soldatovi* BERG, 1914, 'Faune Russ., Poiss.,' III, pt. 2, p. 461, Fig. 63. Amur River.

***Gobio soldatovi minulus** NICHOLS, 1925, Amer. Mus. Novitates, No. 181, p. 3. Shansi.

***Gobio soldatovi slodatovi** BERG.

Gobio gobio var. *soldatovi* BERG, 1914, 'Faune Russ., Poiss.,' III, pt. 2, p. 461, Fig. 63. Amur River.

Specimens examined from Anhwei, Chihli.

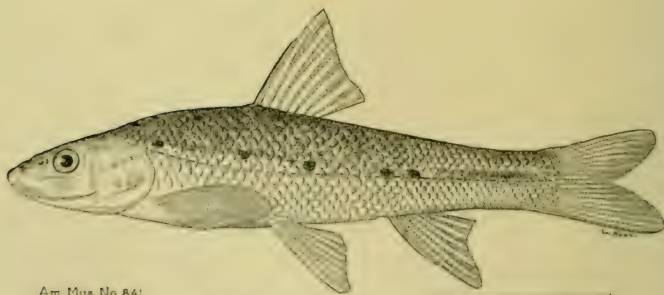


Fig. 27. *Gobio rivuloides*, 126 mm. standard length.



Am. Mus. No. 6419

Fig. 28. *Gobio longipinnis*, type.



Am. Mus. No. 841

Fig. 29. *Gobio coriparoides*, type.

***Gobio rivuloides** NICHOLS, 1925, Amer. Mus. Novitates, No. 181, p. 5. Shansi.

Gobio vaillanti (SAUVAGE).

Rhinogobio vaillanti SAUVAGE, 1878, Bull. Soc. Phil. Paris, II, p. 87. Eastern Kiangsi at 300 meters.

***Gobio longipinnis** NICHOLS, 1925, Amer. Mus. Novitates, No. 181, p. 5. Tungting Lake.

***Gobio coriparoides** NICHOLS, 1925, Amer. Mus. Novitates, No. 181, p. 4. Shansi.

COREIUS Jordan and Starks

JORDAN AND STARKS, 1905, Proc. U. S. Nat. Mus., XXVIII, p. 197. Type: *Labeo cetopsis* Kner.

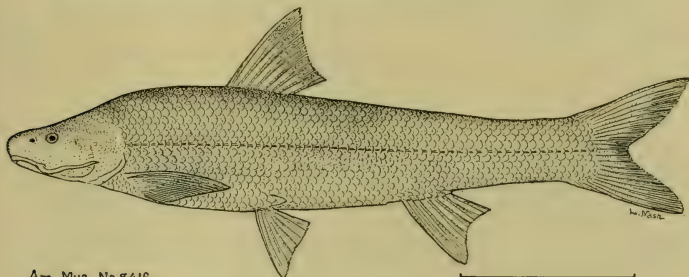
Coreius cetopsis (KNER).

Labeo cetopsis KNER, 1867, "Novara," Fische, p. 351, Pl. xv, fig. 2. Shanghai.

***Coreius styani** (GÜNTHER).

Pseudogobio styani GÜNTHER, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 224. Ki Kiang.

Specimens examined from Tungting Lake (Hunan).



Am. Mus. No. 8416

Fig. 30. *Coreius septentrionalis*, type.

***Coreius septentrionalis** (NICHOLS).

Coripareius septentrionalis NICHOLS, 1925, Amer. Mus. Novitates, No. 181, p. 2. Yellow River.

Specimens examined from Paotou, Móngolia.

AGENIGOBIO Sauvage

SAUVAGE, 1878, Bull. Soc. Phil. Paris, II, p. 87. Type: *Agenigobio halsoneti* Sauvage.

Agenigobio halsoneti SAUVAGE, 1878, Bull. Soc. Phil. Paris, II, p. 87. China.

RHINOBOBIO Bleeker

BLEEKER, 1870, Versl. Akad. Amst., (2) IV, p. 253. Type: *Rhinogobio typus* Bleeker.

***Rhinogobio cylindricus** GÜNTHER, 1888, Ann. Mag. Nat. Hist., (6) I, p. 432.

Specimens examined from Tungting Lake (Hunan).

***Rhinogobio typus** BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 29, Pl. III, fig. 1. Yangtze?

Specimens examined from Tungting Lake (Hunan), Yenping.

PSEUDOGOBIO Bleeker

BLEEKER, 1860, 'Prodr. Cypr.', p. 215. Type: *Gobio esocinus* Temminck and Schlegel.

(**ABBOTTINA**) Jordan and Fowler

JORDAN AND FOWLER, 1903, Proc. U. S. Nat. Mus., XXVI, p. 835. Type: *Abbottina psegma* Jordan and Fowler.

***Pseudogobio rivularis** (BASILEWSKI).

Gobio rivularis BASILEWSKI, 1855, N. Mem. Soc. Nat. Mosc., X, p. 231. North China.

Specimens examined from Chihli; Shansi.

***Pseudogobio sinensis** (KNER).

Tylognathus sinensis KNER, 1865-67, "'Novara," Reise, I, Fische, p. 354, Pl. xv, fig. 5. Shanghai.

Specimens examined from Tungting Lake (Hunan); Shaohsing; Anhwei; Fukien.

(**PSEUDOGOBIO**) Bleeker

BLEEKER, 1860, 'Prodr. Cypr.', p. 215. Type: *Gobio esocinus* Temminck and Schlegel.

***Pseudogobio chinssuensis** NICHOLS, 1926, Amer. Mus. Novitates, No. 214, p. 3, Fig. 3. Shansi.

Pseudogobio (?) filifer GARMAN.

Pseudogobio filifer GARMAN, 1912, Mem. Mus. Comp. Zool., XL, p. 121. Hupeh; Changyanghsien, Yangtze.

***Pseudogobio fukiensis** NICHOLS, 1926, Amer. Mus. Novitates, No. 224, p. 5, Fig. 4. Fukien.

Pseudogobio kachekensis OSHIMA, 1926, Annot. Zool. Japon., XI, p. 13. Kachek River, Hainan.

***Pseudogobio tungtingensis** NICHOLS, 1926, Amer. Mus. Novitates, No. 214, p. 4, Fig. 4. Tungting Lake.

***Pseudogobio labeoides** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 357, Fig. 23. Hainan.

Pseudogobio chaoi EVERMANN AND SHAW, 1927, Proc. Calif. Acad. Sci., XIV, p. 106. Nanking.

SAUROGOBIO Bleeker

BLEEKER, 1870, Versl. Akad. Amst., (2) IV, p. 253. Type: *Saurogobio dumerili* Bleeker.

***Saurogobio drakei** (ABBOTT).

Pseudogobio drakei ABBOTT, 1901, Proc. Nat. Mus., XXIII, p. 486, Fig. Chihli.

Specimens examined from Tungting Lake (Hunan).

***Saurogobio productus** (PETERS).

Pseudogodio productus PETERS, 1880, M. B. Berl. Akad., p. 1035, Fig. 6 (head). Hongkong.

Specimens exained from Anhwei.

***Saurogobio dabryi** BLEEKER, 1871, Verh. Wet. Ak. Amst., Nat., XII, p. 27, Pl. v, fig. 1. Yangtze?

Specimens examined from Tungting Lake (Hunan).

Saurogobio guichenoti SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., (6) I, Art. 5, p. 10. Yangtze.

***Saurogobio dumerili** BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 25, Pl. i, fig. 1. Yangtze?

Specimens examined from Tungting Lake (Hunan).

SARCOCHEILICHTHYS Bleeker

BLEEKER, 1859, Nat. Tijds. Ned.-Ind., XX, p. 435. Type: *Leuciscus variegatus* Temminck and Schlegel.

(**CHILOGOBIO**) Berg

BERG, 1914, 'Faun. Russ., Poiss.,' III, pt. 2, p. 488. Type: *Chilogobio soldatovi* Berg.

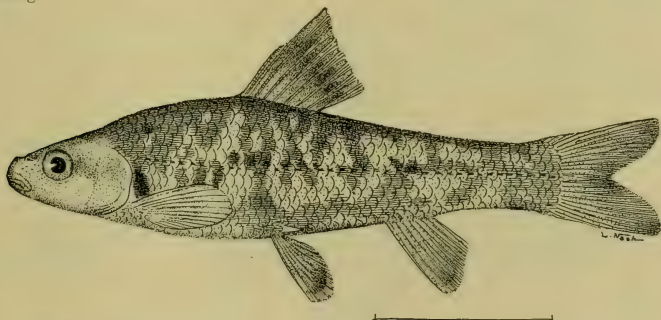


Fig. 31. *Sarcocheilichthys nigripinnis tungting*, 80 mm. standard length.

Sarcocheilichthys imberbis (SAUVAGE AND DABRY DE THIERSANT).

Gobio imberbis SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., (6) I, Art. 5, p. 9. Southern Shensi.

Sarcocheilichthys maculatus (GÜNTHER).

Pseudogobio maculatus GÜNTHER, 1888, Ann. Mag. Nat. Hist., (6) I, p. 432. Yangtze.

***Sarcocheilichthys hainanensis** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 352, Fig. 21, Pl. xxvi, fig. 3. Hainan.

***Sarcocheilichthys scaphignathus** (NICHOLS).

Georgichthys scaphignathus NICHOLS, 1918, Proc. Biol. Soc. Wash., XXXI, p. 17. Fukien.

Specimens examined from Fukien.

Sarcocheilichthys nigripinnis (GÜNTHER).

Gobio nigripinnis GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 246.

***Sarcocheilichthys nigripinnis nigripinnis** (GÜNTHER).

Gobio nigripinnis GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 246, Shanghai.

Specimens examined from Anhwei.

Sarcocheilichthys nigripinnis sciistius (Abbott).

Leuciscus sciistius ABBOTT, 1901, Proc. U. S. Nat. Mus., XXIII, p. 487, Fig. Tientsin.

***Sarcocheilichthys nigripinnis tungting** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 354. Tungting Lake.

(BARBODON) Dybowski

DYBOWSKI, 1872, Verh. Zool. Bot. Ges. Wien, XXII, p. 216. Type: *Barbodon lacustris* Dybowski.

***Sarcocheilichthys sinensis sinensis** BLEEKER.

Sarcocheilichthys sinensis BLEEKER, 1871, Verh. Akad. Wet. Amst., Nat., XII, p. 31. Pl. iv, fig. 2. Yangtze?

Specimens examined from Tungting Lake (Hunan), and Anhwei.

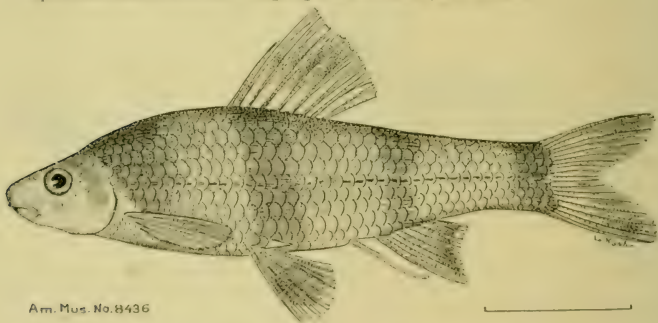


Fig. 32. *Sarcocheilichthys sinensis fukiensis*, type.

***Sarcocheilichthys sinensis fukiensis** NICHOLS, 1925, Amer. Mus. Novitates, No. 185, p. 3. Fukien.

COBITIDÆ

GOBIOBOTIA Kreyenberg

KREYENBERG, 1911, Zool. Anz., XXXVIII, p. 417. Type: *Gobiobotia pappenheimi* Kreyenberg.

***Gobiobotia pappenheimi** Kreyenberg, 1911, Zool. Anz., XXXVIII, p. 417. Figs. 1-3. China.

Specimens examined from Tungting Lake (Hunan).

COBITIS Linnaeus

LINNAEUS, 1758, 'Syst. Nat.,' 10th Ed., p. 300. Type: *Cobitis taenia* Linnaeus.

Cobitis taenia Linnaeus, 1758, 'Syst. Nat.,' 10th Ed., p. 303. Europe.

***Cobitis taenia dolichorhynchus** NICHOLS.

Cobitis dolichorhynchus NICHOLS, 1918, Proc. Biol. Soc. Wash., XXXI, p. 16. Fukien.



Am. Mus. No. 8403

Fig. 33. *Cobitis taenia melanoleuca*, type.

***Cobitis taenia melanoleuca** NICHOLS, 1925, Amer. Mus. Novitates, No. 170, p. 3. Shansi.

***Cobitis taenia sinensis** SAUVAGE AND DABRY DE THIERSANT.

Cobitis sinensis SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., Zool., I, Art. 5, p. 16. Western Szechwan.

***Cobitis macrostigma** DABRY DE THIERSANT, 1872, 'Pisc. Chin.,' Pl. XLIX, fig. 4. Lakes of Central China.

Specimens examined from Tungting Lake (Hunan).

ACANTHOPSIS Van Hasselt

VAN HASSELT, 1823, Allg. Konst. Lett., II, p. 133. Type: *Acanthopsis dialyzona* Van Hasselt.

Acanthopsis lachnostoma RUTTER, 1897, Proc. Ac. Phila., p. 60. Swatow.

BOTIA Gray

GRAY, 1831, 'Zoöl. Misc.,' 1831, p. 8. Type: *Botia almorhæ* Gray.

***Botia citraurata** NICHOLS, 1925, Amer. Mus. Novitates, No. 177, p. 5. Tungting Lake.

Botia pratti GÜNTHER, 1892, in Pratt, 'Snows of Tibet, etc.,' p. 250, Pl. IV, fig. A. Szechwan.

***Botia purpurea** NICHOLS, 1925, Amer. Mus. Novitates, No. 177, p. 4, Fig. 3. Tungting Lake.

***Botia rubrilabris** (DABRY DE THIERSANT).

Parabotia rubrilabris DABRY DE THIERSANT, 1872, 'Pisc. Chin.,' Pl. XLIX, fig. 8. Yangtze.

Specimens examined from Tungting Lake (Hunan).

Botia superciliaris GÜNTHER, 1892, in Pratt, 'Snows of Tibet, etc.,' p. 250, Pl. IV, fig. B. Szechwan.

LEPTOBOTIA Bleeker

BLEEKER, 1870, Versl. Akad. Wet. Amst., (2) IV, p. 256. Type: *Botia elongata* Bleeker.

Leptobotia elongata (BLEEKER).

Botia elongata BLEEKER, 1870, Versl. Akad. Wet. Amst., IV, p. 254, Fig. Yangtze.

****Leptobotia fasciata*** (DABRY DE THIERSANT).

Parabotia fasciatus (Guichenot) DABRY DE THIERSANT, 1872, 'Pisc. Chin.,' Pl. XLIX, fig. 7. Yangtze.

Specimens examined from Tungting Lake (Hunan), Anhwei.

MISGURNUS Lacépède

LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 16. Type: *Cobitis fossilis* Linnæus.

Misgurnus anguillicaudatus (CANTOR).

Cobitis anguillicaudata CANTOR, 1842, Ann. Mag. Nat. Hist., IX, p. 485. Chusan.

Specimens examined from Chihli and Shansi.



Am. Mus. No. 8393

Fig. 34. *Misgurnus anguillicaudatus tungting*, type.

****Misgurnus anguillicaudatus anguillicaudatus*** (CANTOR).

Cobitis anguillicaudata CANTOR, 1842, Ann. Mag. Nat. Hist., IX, p. 485. Chusan. Specimens examined from Anhwei, Fukien.

****Misgurnus anguillicaudatus tungting*** NICHOLS, 1925, Amer. Mus. Novitates, No. 169, p. 3. Tungting Lake.



Am. Mus. No. 8394

Fig. 35. *Misgurnus mizolepis fukien*, type.

Misgurnus crossochilus SAUVAGE, 1878, Bull. Soc. Philom. Paris, p. 89. High mountains of Koaten.

Misgurnus mizolepis GÜNTHER, 1858, Ann. Mag. Nat. Hist., (6) I, p. 433. Yangtze.

***Misgurnus mizolepis grangeri** NICHOLS, 1925, Amer. Mus. Novitates, No. 169, p. 5. Szechwan.

***Misgurnus mizolepis hainan** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 336, Fig. 9, Pl. XXVI, fig. 1. Hainan.

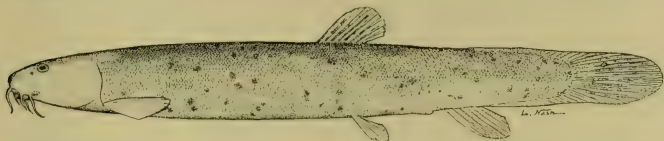
Misgurnus mizolepis punctatus OSHIMA.

Misgurnus punctatus OSHIMA, 1926, Annot. Zool. Japon., XI, p. 5. Kachek River, Hainan.

***Misgurnus mizolepis fukien** NICHOLS, 1925, Amer. Mus. Novitates, No. 169, p. 4. Fukien.

***Misgurnus mizolepis mizolepis** GÜNTHER,

Misgurnus mizolepis GÜNTHER, 1888, Ann. Mag. Nat. Hist., (6) I, p. 433. Yangtze.



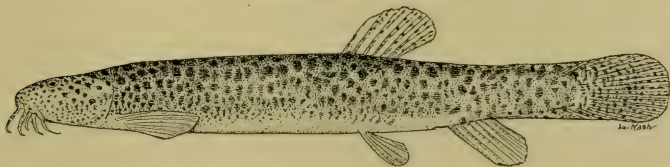
Am. Mus. No. 8395

Fig. 36. *Misgurnus mizolepis grangeri*, type.



Am. Mus. No. 8396

Fig. 37. *Misgurnus mohoity yunnan*, type.



Am. Mus. No. 8397

Fig. 38. *Misgurnus mohoity leopardus*, type.

Specimens examined from Tungting Lake (Hunan), Anhwei.

Misgurnus mohoity (DYBOWSKI).

Cobitis fossilis var. *mohoity* DYBOWSKI, 1869, Verh. Zool.-Bot. Gesell. Wien, XIX, p. 957. From east of Lake Baical.

***Misgurnus mohoity yunnan** NICHOLS, 1925, Amer. Mus. Novitates, No. 169, p. 5. Yunnan.

***Misgurnus mohoity leopardus** NICHOLS, 1925, Amer. Mus. Novitates, 1925, No. 169, p. 6. Tungting Lake.

PARAMISGURNUS Sauvage

SAUVAGE, 1878, Bull. Soc. Phil. Paris, (2) VII, p. 90. Type: *Paramisgurnus dabryanus* Sauvage.

Paramisgurnus dabryanus SAUVAGE, 1878, Bull. Soc. Philom. Paris, pp. 89 and 90. Attributed to Guichenot. Yangtze.

OREONECTES Günther

GÜNTHER, 1868, 'Cat.,' VII, p. 369. Type: *Oreonectes platycephalus* Günther.

Oreonectes platycephalus GÜNTHER, 1868, 'Cat.,' VII, p. 369.

NEMACHEILUS Van Hasselt

VAN HASSELT, 1823, 'Poiss. Jave,' Allg. Konst. Lett., II, p. 133. Type: *Cobitis fasciatus* Valenciennes.

(NEMACHEILUS) Van Hasselt

VAN HASSELT, 1823, 'Poiss. Jave,' Allg. Konst. Lett., II, p. 133. Type: *Cobitis fasciatus* Valenciennes.

***Nemacheilus pulcher** NICHOLS AND POPE, 1926, Bull. Amer. Mus. Nat. Hist., LIV, p. 338, Fig. 10, Pl. xxvi, fig. 2. Hainan.

(YUNNANILUS) Nichols

NICHOLS, 1925, Amer. Mus. Novitates, No. 171, p. 1. Type: *Nemacheilus pleurotænia* Regan.

***Nemacheilus nigromaculatus** REGAN.

Nemachilus nigromaculatus REGAN, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 192. Yunnan.

Specimen examined from Yunnan.

***Nemacheilus pleurotænia** REGAN.

Nemachilus pleurotænia REGAN, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 192. Yunnan.

Specimens examined from Yunnan.

Nemacheilus salmonides CHAUDHURI.

Nemachilus salmonides CHAUDHURI, 1912, Rec. Ind. Mus., VI, p. 18, Pl. i, figs. 3, 3a. Yunnan.

LEFUA Herzenstein

HERZENSTEIN, 1888, 'Wiss. Res. Przewalski Reis., Zool.,' III, pt. 2, No. 1, p. 3. Type: *Octonema pleskei* Herzenstein.

***Lefua costata** (KESSLER).

Diplophysa costata KESSLER, 1876, in Prejevalsky's 'Mongolia,' II, pt. 4, p. 29, Fig. 4. Dalai Nor.

Specimens examined from Chihli, Shansi.

***Lefua andrewsi** FOWLER, 1922, Amer. Mus. Novitates, No. 38, p. 1. Chihli.

Specimens examined from Chihli, Shansi.

BARBATULA Linck

LINCK, 1790, Mag. Nuest. Phys. Nat. Gotha, p. 38. Type: *Cobitis barbatula* Linnæus.

(BARBATULA) Linck

LINCK, 1790, Mag. Nuest. Phys. Nat. Gotha, p. 38. Type: *Cobitis barbatula* Linnæus.

Barbatula bleekeri (SAUVAGE AND DABRY DE THIERSANT).

Nemachilus bleekeri SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., I, No. 5, p. 15. Yenkiatsoun, western Shensi.

Barbatula (?) dabryi (SAUVAGE).

Oreias dabryi SAUVAGE, 1874, Journ. and Mag. Zool., II, p. 334. Eastern Tibet. China (Sauvage and Dabry de Thiersant).

Barbatula (?) livida (SAUVAGE AND DABRY DE THIERSANT).

Nemachilus lividus SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., I, No. 5, p. 15. China.

Barbatula robusta (KESSLER).

Nemachilus robustus KESSLER, 1876, in Prejevalsky's 'Mongolia,' II, pt. 4, p. 32. Kansu.

Barbatula toni (DYBOWSKI).

Cobitis toni DYBOWSKI, 1869, Verh. Zool.-Bot. Gesell. Wien, XIX, p. 597, Pl. XVIII, fig. 10. Transbaikalia.



Fig. 39. *Barbatula toni fowleri*, type.

***Barbatula toni fowleri** NICHOLS, 1925, Amer. Mus. Novitates, No. 171, p. 3. Chihli.

***Barbatula toni posteroventralis** NICHOLS, 1925, Amer. Mus. Novitates, No. 171, p. 4. Shansi.

Barbatula yarkandensis (Day).

Nemacheilus yarkandensis DAY, 1876, Proc. Zool. Soc. London, p. 796. Yarkand.

***Barbatula yarkandensis sellæfer** NICHOLS, 1925, Amer. Mus. Novitates, No. 171, p. 4. Shansi.

***Barbatula stoliczkai** (STEINDACHNER).

Cobitis stoliczkai STEINDACHNER, 1866, Verh. Zool.-Bot. Gesell. Wien, XVI, p. 793, Pl. XIV, fig. 2. Central Asia.

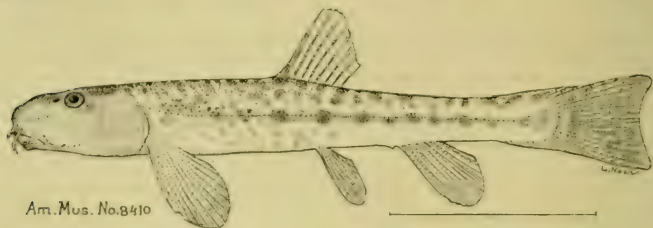
Specimens examined from Shansi.

Barbatula (?) variegata (SAUVAGE AND DABRY DE THIERSANT).

Nemachilus variegatus SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., I, No. 5, p. 14; credited to Dabry de Thiersant. China.

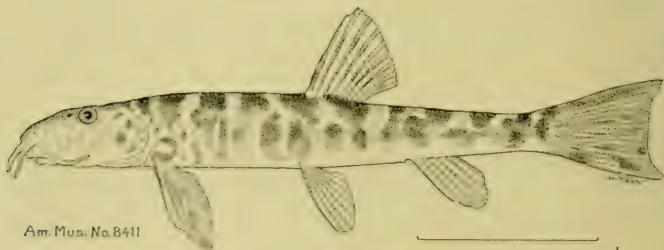
Barbatula grahami (REGAN).

Nemachilus grahami REGAN, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 333. Yunnan fu.



Am. Mus. No. 8410

Fig. 40. *Barbatula toni posteroventralis*, type.



Am. Mus. No. 8411

Fig. 41. *Barbatula yarkandensis sellaefer*, type.

(HOMATULA) Nichols

NICHOLS, 1925, Amer. Mus. Novitates, No. 171, p. 2. Type: *Nemachilus potanini* Günther.

Barbatula berezowskii GÜNTHER.

Nemachilus berezowskii GÜNTHER, 1896, Ann. Mus. Zool. St. P., p. 217, Pl. II, fig. C. Hui-hsien, Kansu.

Barbatula potanini (GÜNTHER).

Nemachilus potanini GÜNTHER, 1896, Ann. Mus. Zool. St. P., pt. I, p. 218. River Ya.

Specimens examined from Szechwan.

Barbatula oxygnathus (REGAN).

Nemachilus oxygnathus REGAN, 1908, Ann. Mag. Nat. Hist., (8) II, p. 357. Yunnan fu.

HOMALOPTERA Van Hasselt

VAN HASSELT, 1823, Poiss. Jave Allg. Konst. Lett., II, p. 130. Type: *Homaloptera fasciata* Van Hasselt.

(HOMALOPTERA) Van Hasselt

VAN HASSELT, 1823, 'Poiss. Jave.' Allg. Konst. Lett., II, p. 130. Type: *Homaloptera fasciata* Van Hasselt.

***Homaloptera fasciolata** NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 339, Fig. 11. Hainan. [Belongs in *Homatula*, p. 46.]

Homaloptera sinensis (SAUVAGE AND DABRY DE THIERSANT).

Psilorhynchus sinensis SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., (6) I, Art. 5, p. 14. Szechwan.

(OCTONEMA) Martens

MARTENS, 1868, Monatb. Ak. Wiss. Berl. for 1868, p. 608. Type: *Homaloptera rotundicauda* Martens.

Homaloptera rotundicauda MARTENS, 1868, Monatb. Ak. Wiss. Berl. for 1868, p. 608. Hongkong.

Hongkong (Gee).

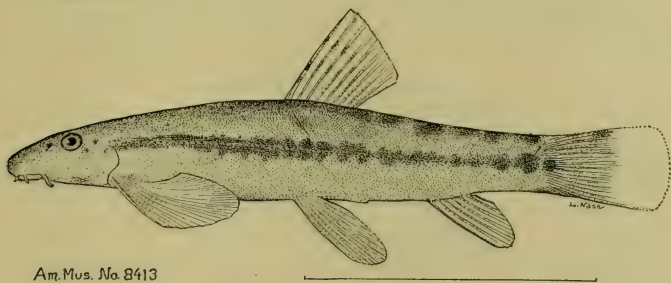


Fig. 42. *Homaloptera caldwelli*, type.

(HOMALOSOMA) Boulenger

BOULENGER, 1901, Proc. Zoöl. Soc., pt. 1, p. 270, Pl. xxiii, fig. 3. Type: *Homalosoma stenosoma* Boulenger.

Homaloptera stenosoma (BOULENGER).

Homalosoma stenosoma BOULENGER, 1901, Proc. Zoöl. Soc., pt. 1, p. 270, Pl. xiii, fig. 3. Ningpo.

***Homaloptera caldwelli** NICHOLS, 1925, Amer. Mus. Novitates, No. 172, p. 1. Fukien.

LEPTURICHTHYS Regan

REGAN, 1911, Ann. Mag. Nat. Hist., (8) VIII, p. 31. Type: *Homaloptera fimbriata* Günther.

***Lepturichthys fimbriata** (GÜNTHER).

Homaloptera fimbriata GÜNTHER, 1888, Ann. Mag. Nat. Hist., (6) I, p. 433. Yangtze.

Specimens examined from Tungting Lake (Hunan).

CROSSOSTOMA Sauvage

SAUVAGE, 1876-79, Bull. Soc. Phil. Paris, p. 88. Type: *Crossostoma davidi* Sauvage.

**Crossostoma davidi* SAUVAGE, 1876-79, Bull. Soc. Phil. Paris, p. 88. Fukien. Specimens examined from Fukien.

**Crossostoma fascicauda* NICHOLS, 1926, Amer. Mus. Novitates, No. 224, p. 2, Fig. 2. Fukien.

**Crossostoma stigmata* NICHOLS, 1926, Amer. Mus. Novitates, No. 224, p. 4, Fig. 3. Fukien.

HEMIMYZON Regan

REGAN, 1911, Ann. Mag. Nat. Hist., (8) VIII, p. 32. Type: *Homaloptera formosana* Boulenger.

(PSEUDOGASTROMYZON) Nichols

NICHOLS, 1925, Amer. Mus. Novitates, No. 167, p. 1. Type: *Hemimyzon zebroidus* Nichols.

**Hemimyzon zebroidus* NICHOLS, 1925, Amer. Mus. Novitates, No. 167, p. 1. Fukien.

GASTROMYZON Günther

GÜNTHER, 1874, Ann. Mag. Nat. Hist., XIV, p. 454. Type: *Gastromyzon borneensis* Günther.

**Gastromyzon leveretti* NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 340, Fig. 12. Hainan.

CYPRINODONTIDÆ

APLOCHEILUS McClelland

MCCLELLAND, 1839, 'Ind. Cyprin.,' p. 301. Type: *Aplocheilus melastigmus* McClelland.

(ORYZIAS) Jordan and Snyder

JORDAN AND SNYDER, 1906, Proc. U. S. Nat. Mus., XXXI, p. 289, Type: *Pæcilia latipes* Temminck and Schlegel.

**Aplocheilus curvinotus* NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 380, Fig. 43. Hainan.

**Aplocheilus latipes* (TEMMINCK AND SCHLEGEL).

Pæcilia latipes TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 224, Pl. ciii, fig. 5. Japan.

Specimens examined from Szechwan, ?, Chihli.

(PANCHAX) Cuvier and Valenciennes

CUVIER AND VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XVIII, p. 380. Type: *Panchax buchunani* Cuvier and Valenciennes, equals *Esox panchax* Hamilton-Buchanan.

Aplocheilus rubropunctatus STEINDACHNER.

Haplocheilus (Panchax) rubropunctatus STEINDACHNER, 1867, Sitzb. (Math.-Nat.) Akad. Wien, LVI, p. 345. China and Ceylon.

HEMIRAMPHIDÆ**HYPORHAMPHUS** Gill

GILL, 1860, Proc. Acad. Phila. for 1859, p. 131. Type: *Hyporhamphus tricuspidatus* Gill.

***Hyporhamphus sinensis** (GÜNTHER).

Hemirhamphus sinensis GÜNTHER, 1866, 'Cat. Fishes,' VI, p. 265. China.

Specimens examined from Tungting Lake (Hunan).

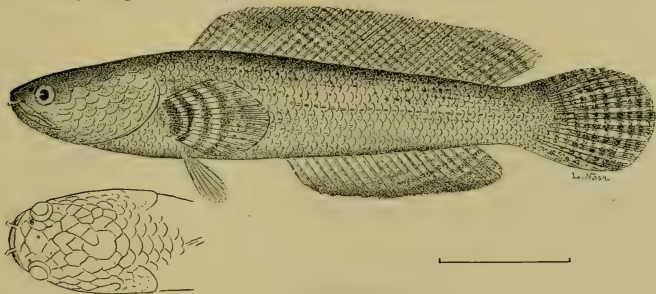
GASTEROSTEIDÆ**PYGOSTEUS** Gill

GILL, 1862, 'Cat. Fish. East Coast N.A.,' Proc. Acad. Phila. for 1861, Suppl., p. 39. Name only (credited to Brevoort). 1865, Canadian Nat., II, p. 8. Type: *Gasterosteus occidentalis* Cuvier and Valenciennes = *Gasterosteus pungitius* Linnæus.

Pygosteus sinensis (GUICHENOT).

Gasterosteus sinensis GUICHENOT, 1869, Nouv. Arch. Mus. Hist. Nat. Paris, V, p. 204, Pl. XII, fig. 4. China (?Yangtze).

Chihli, Yangtze (Reeves, 1927).

**OPHICEPHALIDÆ****OPHICEPHALUS** Bloch

BLOCH, 1793, 'Ausl. Fische,' VII, p. 137. Type: *Ophicephalus punctatus* Bloch.

***Ophicephalus argus** CANTOR, 1842, Ann. Mag. Nat. Hist., IX, p. 484.

Fig. 43. *Ophicephalus gachua*, 100 mm. standard length.

Specimens examined from Yunnan and Anhwei.

***Ophicephalus maculatus** (LACÉPÈDE).

Bostrychus maculatus LACÉPÈDE, 1802, 'Hist. Nat. Poiss.,' III, pp. 140, 143. No locality.

Specimens examined from Tungting Lake (Hunan), Fukien, Hainan.

Ophicephalus striatus BLOCH, 1793, 'Ausl. Fische,' VII, p. 141, Pl. CCCLIX. Malabar.

South China (Gee).

Ophicephalus aspilotus SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., (6) I, p. 4. China.

***Ophicephalus gachua** HAMILTON-BUCHANAN.

Ophicephalus gachua HAMILTON-BUCHANAN, 1822, 'Fishes in Ganges,' p. 68. Ganges River.

Specimens examined from Hainan Island.

Ophicephalus marulius HAMILTON-BUCHANAN.

Ophicephalus marulius HAMILTON-BUCHANAN, 1822, 'Fishes in Ganges,' pp. 65, 367, Pl. xvii, fig. 19. Ganges River.

Generally credited to China. Yangtze; Kiangsu (*O. grandiosus* Cuvier and Valenciennes, Reeves, 1927).

CHANNA Scopoli

Channa (Gronow, 1763, 'Zoophylaceum') SCOPOLI, 1777, Int. Hist. Nat., p. 459. Type: *Channa orientalis* Bloch and Schneider.

***Channa ocellata** PETERS, 1864, Monatber. Acad. Wiss. Berl., p. 384. China.

Swatow, Yenping (Gee). Specimens examined from Tungting Lake (Hunan), Anhwei, Fukien, Hainan Island.

OSPHRONEMIDÆ

Macropodus Lacépède

LACÉPÈDE, 1802, 'Hist. Nat. Poiss.,' III, p. 416. Type: *Macropodus viridiauratus* Lacépède.

***Macropodus opercularis** (LINNÆUS).

Labrus opercularis LINNÆUS, 1788, Amoen. Acad., IV, p. 428. China. Ningpo, Shanghai, Chihli (Gee). Specimens examined from Tungting Lake (Hunan), Anhwei.

***Macropodus viridiauratus** LACÉPÈDE, 1802, 'Hist. Nat. Poiss.,' III, p. 416. China.

Specimens examined from Fukien, Hainan Island.

OSPHRONEMUS Lacépède

LACÉPÈDE, 1802, 'Hist. Nat. Poiss.,' III, p. 116. Type: *Osphronemus goramy* Lacépède.

Osphronemus goramy LACÉPÈDE, 1802, 'Hist. Nat. Poiss.,' III, pp. 116 and 117. East Indies.

Generally credited to China.

ANABANTIDÆ

ANABAS Cuvier

CUVIER, 1817, 'Règne Animal,' (1st Ed.) II, p. 339. Type: *Perca scandens* Daldorff.

Anabas scandens (DALDORFF).

Perca scandens DALDORFF, 1797, Trans. Linn. Soc. Lond., III, p. 62. Tranquebar. Haiho, Hainan (Oshima).

AMBASSIDÆ

AMBASSIS Cuvier and Valenciennes

CUVIER AND VALENCIENNES, 1828, 'Hist. Nat. Poiss.,' II, p. 175. Type: *Centropomus ambassis* Lacépède (*Ambassis commersoni* Cuvier and Valenciennes).

Ambassis gymnocephalus (LACÉPÈDE).

Lutjanus gymnocephalus Lacépède, 1802, 'Hist. Nat. Poiss.,' III, Pl. XXIII, fig. 3. Sumatra.

Kachek River, Hainan (Oshima).

SERRANIDÆ

LATES Cuvier and Valenciennes

CUVIER AND VALENCIENNES, 1828, 'Hist. Nat. Poiss.,' II, p. 88. Type: *Perca nilotica* Linnaeus.

Lates calcarifer (BLOCH).

Holocentrus calcarifer BLOCH, 1785, 'Ichthyologie,' Pl. CCXLIV. "Japan" (text, 1790, IV, p. 101).

Kachek River, Hainan (Oshima).

LATEOLABRAX Bleeker

BLEEKER, 1857, Verh. Batav. Gen., XXVI, p. 53. Type: *Labrax japonicus* Cuvier and Valenciennes.

***Lateolabrax japonicus** (CUVIER AND VALENCIENNES).

Labrax japonicus CUVIER AND VALENCIENNES, 1828, 'Hist. Nat. Poiss.,' II, p. 85. Japan.

Ningpo, Shanghai, Chinwangtao (Gee). Specimens examined from Fukien.

SINIPERCA Gill

GILL, 1862, Proc. Acad. Phila., p. 16. Type: *Perca chuatsi* Basilewski.

***Siniperca chuatsi** (BASILEWSKI).

Perca chuatsi BASILEWSKI, 1855, N. Mem. Soc. Nat. Mosc., X, Pl. II, fig. 1. North China.

Specimens examined from Anhwei.

***Siniperca chuatsi** (BASILEWSKI).

Perca chuatsi BASILEWSKI, 1855, N. Mem. Soc. Nat. Mosc., X, p. 218, Pl. I, fig. 1. North China.

Specimens examined from Anhwei, Tungting Lake (Hunan), Fukien.

***Siniperca scherzeri** STEINDACHNER, 1892, Anzg. Ac. Wien, XXIX, p. 130; Denks. Akad. Wien, LIX, pt. 1, p. 357, Pl. I, fig. 1. Yangtze.

Specimens examined from Tungting Lake (Hunan).

COREOPERCA Herzenstein

HERZENSTEIN, 1896, Ann. Ac. St. Pet., p. 11. Type: *Coreoperca herzi* Herzenstein.

Coreoperca herzi HERZENSTEIN, 1896, Ann. Ac. St. Pet., p. 11. Korea. North China (Reeves, 1927).



Fig. 44. *Siniperca chuatsi*, 110 mm. standard length.

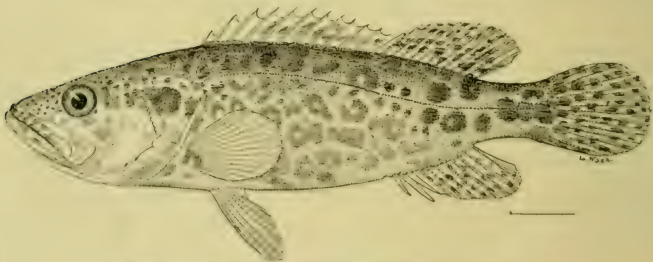


Fig. 45. *Siniperca scherzeri*, from Tungting Lake.

***Coreoperca whiteheadi** BOULENGER, 1899, Proc. Zool. Soc. London, pt. 2, p. 960. Hainan.

Specimens examined from Hainan.

EPINEPHELUS Bloch

BLOCH, 1793, 'Nat. Aust. Fische,' VII, p. 11. Type: *Epinephelus marginalis* Bloch, equals *Perca fasciata* Forskål.

***Epinephelus susuki** (CUVIER AND VALENCIENNES).

Plectropoma susuki CUVIER AND VALENCIENNES, 1828, 'Hist. Nat. Poiss.,' II, p. 404. Japan.

Plectropoma susuki Temminck and Schlegel, 1847, 'Fauna Japonica,' p. 11, Pl. iv, fig. 1. Japan.

Specimens examined from Anhwei.

TETRAODONTIDÆ

TETRAODON Linnæus

LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., p. 332. Type: *Tetraodon lineatus* Linnæus.

***Tetraodon ocellatus** LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., p. 333. (after *Diodon ocellatus* Osbeck).

Pei Ho, Tientsin (Gee). Specimens examined from Anhwei, Fukien.

COTTIDÆ

COTTUS Linnæus

LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., p. 264. Type: *Cottus gobio* Linnæus.

Cottus poecilopus HECKEL, 1836, Ann. Wien Mus., II, p. 145, Pl. VIII, figs. 1-2. Europe.

North China (Gee, as *C. gobio*).

GobiIDÆ

ELEOTRIS Gronow

GRONOW, 1763, 'Zoophylaceum,' p. 83. BLOCH AND SCHNEIDER, 1801. Type: *Gobius pisonis* Gmelin.

***Eleotris balia** JORDAN AND SEALE, 1906, Proc. U. S. Nat. Mus., XXIX. China, probably Hongkong.

Specimens examined from Fukien.

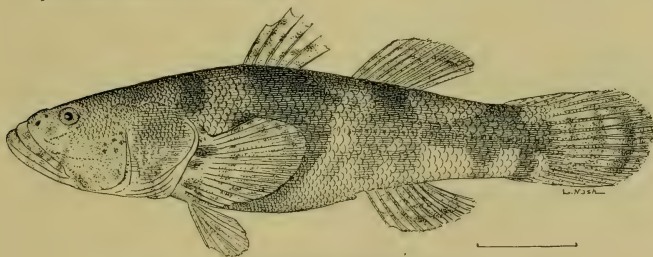


Fig. 46. *Eleotris potamophila*, 135 mm. standard length.

Eleotris davidi SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., (6) I, Art. 5, p. 3. Ningpo.

Eleotris oxycephala TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 149, Pl. LXXVII, figs. 4, 5. Japan.

Hainan (Oshima).

***Eleotris potamophila** GÜNTHER, 1861, 'Cat.,' III, p. 557. Yangtze. Chikiang

Shanghai (Gee). Specimens examined from Tungting Lake (Hunan), Anhwei.

**Eleotris swinhonis* GÜNTHER, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 242. Shanghai.

Specimens examined from Anhwei.

Eleotris xanthi GÜNTHER, 1888, Ann. Mag. Nat. Hist., (6) I, p. 430. Ichang, Yangtze.

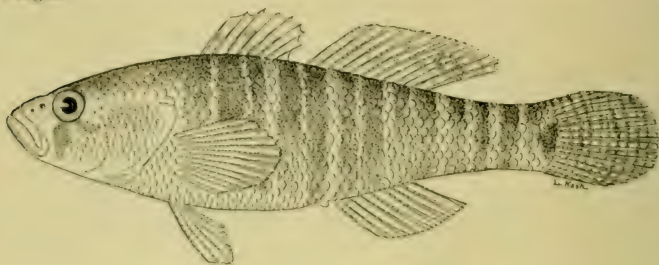


Fig. 47. *Eleotris swinhonis*, 50 mm. standard length.

PHILYPNUS Cuvier and Valenciennes

CUVIER AND VALENCIENNES, 1837, 'Hist. Nat. Poiss.,' XII, p. 255. Type: *Gobiomorus dormitator* Lacépède.

**Philypnus chalmersi* NICHOLS AND POPE, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 390, Fig. 50. Hainan.

MICROPERCOPS Fowler and Bean

FOWLER AND BEAN, 1920, Proc. U. S. Nat. Mus., LVIII, p. 319. Type: *Micropercops dabryi* Fowler and Bean.

Micropercops cinctus (DABRY DE THIERSANT).

Philypnus cinctus DABRY DE THIERSANT, 'Pisc. Chin.,' Pl. xxxvii, fig. 3. Mountains of Kiangsi.

Micropercops dabryi FOWLER AND BEAN, 1920, Proc. U. S. Nat. Mus., LVIII, p. 319, Fig. 2. Soochow.

GوبيUS Linnæus

LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., p. 262. Type: *Gobius niger* Linnæus.

(GLOSSOGوبيUS) Gill

GILL, 1860, Proc. Acad. Nat. Sci. Phila., for 1859, p. 146. Type: *Gobius platycephalus* Richardson.

**Gobius giuris* HAMILTON-BUCHANAN, 1822, 'Fishes in Ganges,' p. 51. Ganges River.

West Africa to east Asia, entering fresh waters. Pei Ho, Tientsin (Gee). Yangtze at Hankau (Kreyenberg and Pappenheim). Specimens examined from Fukien.

Gobius brunneus TEMMINCK AND SCHLEGEL, 1847, 'Fauna Japonica,' p. 142, Pl. LXXIV, fig. 2. Japan.

Hainan (Oshima).

Gobius caninus CUVIER AND VALENCIENNES, 1837, 'Hist. Nat. Poiss.,' XII, p. 86. Java.

Amoy (Günther).

Gobius grammepomus BLEEKER, 1849, Verh. Bat. Gen., XXII, p. 34. East Indies.

Hainan (Oshima).

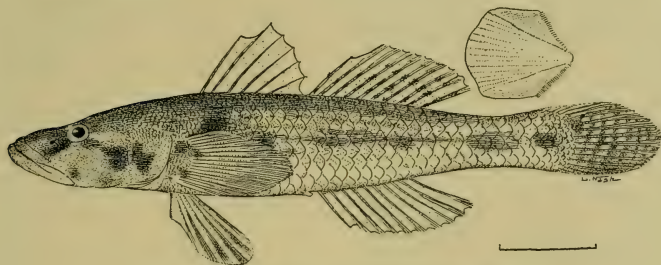
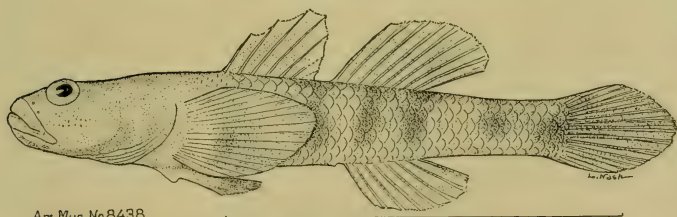


Fig. 48. *Gobius giuris*, 145 mm. standard length.



Am. Mus. No 8438

Fig. 49. *Gobius cliffordpopei*, type.

(RHINOGOBIUS) Gill

GILL, 1860, Proc. Acad. Phila. for 1859, p. 145. Type: *Rhinogobius similis* Gill.

***Gobius cliffordpopei** NICHOLS, 1925, Amer. Mus. Novitates, No. 185, p. 5. Tungting Lake.

Gobius davidi SAUVAGE AND DABRY DE THIERSANT, 1874, Ann. Sci. Nat., (6) I, p. 2. Western Tche-Kiang.

***Gobius giurinus** RUTTER, 1897, Proc. Acad. Phila., XLIX, p. 86. Swatow.

Kachek River, Hainan (Oshima). Specimen examined from Fukien.

Gobius hainanensis (OSHIMA).

Rhinogobius hainanensis OSHIMA, 1926, Annot. Zool. Japon., XI (1), p. 23.
Kachek River, Hainan.

•**Gobius hadropterus** (JORDAN AND SNYDER).

Ctenogobius hadropterus JORDAN AND SNYDER, 1902, Proc. U. S. Nat. Mus., XXIV, p. 60. Japan.

Specimens examined from Anhwei, Fukien, Hainan Island.

(**CTENOGOBIUS**) Gill

GILL, 1858, Ann. Lyc. Nat. Hist., N. Y., VI, p. 374. Type: *Ctenogobius fasciatus* Gill.

Gobius clarki (EVERMANN AND SHAW).

Ctenogobius clarki EVERMANN AND SHAW, 1927, Proc. Calif. Acad. Sci., XIV, p. 119. Chuchi (perhaps marine).

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- vachellii, 6.
vaillanti, 37.
Varicorhinus, 22.
variegata, 46.
variegatus, 15.
virgatus, 6.
- viridiauratus, 50.
vittatus, 14.
- waleckii, 15.
whiteheadi, 52.
wolterstorffi, 34.
- xanthi, 54.
xanthognatha, 4.
Xenocypris, 22.
- yarkandensis, 45.
yunnan, 43.
yunnanensis, 12, 14, 20, 21, 24.
Yunnanilus, 44.
- Zacco, 18.
zebroidus, 48.

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FURTHER NOTES ON MONGOLIAN CRETACEOUS MAMMALS¹

BY GEORGE GAYLORD SIMPSON

In 1923 the Third Asiatic Expedition discovered a mammal skull in the Cretaceous Djadokhta Formation of Mongolia—the second partial Mesozoic mammal skull ever to be described.² Upon learning the importance of this specimen, which was still in the matrix and of doubtful relationships as it left them, the members of the expedition turned with renewed energy to searching for further material of the same sort. Their persistence was richly rewarded with no fewer than six additional partial skulls, as well as fragments indicating two other individuals. These specimens, found in 1925, were described the following year.³

Further collecting has been impossible, but in cleaning up the material already obtained from the Djadokhta an important new find was made. Imbedded and almost completely hidden in a sandstone nodule collected in 1925 was a partial skull representing a new species of *Zalambdalestes*. This skull shows the characters of the upper cheek teeth much more plainly than any of the earlier material and also is the first in which the complete posterior part of the mandible, with the important angular region, is preserved. There are also associated with the skull a broken femur and part of a pelvis—fragmentary but very welcome additional information as to the structure of this genus. Preparation of the first mammal discovered has also revealed some skeletal remains of *Djadochtherium* which were not available at the time of the original description and which prove to be of considerable importance. Description of this additional material and its correlation with what was already known are the aims of the present paper.

¹Publications of The Asiatic Expeditions of The American Museum of Natural History. Contribution No. 84.

²Simpson, G. G. 1925. A Mesozoic Mammal Skull from Mongolia. American Museum Novitates, No. 201.

³Gregory, W. K. & Simpson, G. G. 1926. Cretaceous Mammal Skulls from Mongolia. American Museum Novitates, No. 225.

There are now known from the Djadokhta Formation eight partial skulls with associated portions of lower jaws, one skull without jaws, a fragment of a maxilla, and part of a mandible, the remains of eleven individuals in all. These have been assigned to five genera and six species, as follows:

MULTITUBERCULATA

Ptilodontidae

Djadochtherium matthewi Simpson.

INSECTIVORA

Deltatheridiidae

Deltatheridium pretrituberculare Gregory & Simpson.

Deltatheroides cretacicus Gregory & Simpson.

Hyotheridium dobsoni Gregory & Simpson

Zalambdalestidae

Zalambdalestes lechei Gregory & Simpson

Zalambdalestes grangeri Simpson.

The affinities of the members of this small but unusually important fauna have already been briefly discussed and are to be taken up later in more detail.

The new material, like that already described, was discovered by the Third Asiatic Expedition under the leadership of Roy Chapman Andrews, Walter Granger in charge of paleontology, and has been skillfully prepared by Albert Thomson. The drawings in this paper are by John Germann.

***Zalambdalestes grangeri*, new species**

TYPE.—Amer. Mus. No. 21709. Most of facial portion of skull with right cheek teeth, associated with fragment of lower jaw and with partial pelvis and femur.

HORIZON.—Djadokhta Formation, Upper Cretaceous.

LOCALITY.—Shabarakh Usu, Outer Mongolia. 1925.

SPECIFIC CHARACTERS.— P^{2-1} about as in *Z. lechei*, but molars all more robust and longer relative to their widths.

Although the specimen cannot be made to enter into the genotypic species, it is unquestionably closely related and belongs to the same genus, the characters of which it helps to establish more definitely.

DENTAL FORMULA: One of the most valuable contributions of the new skull is that it clears up some doubts as to the homologies of the teeth and as to the dental formula. The latter may now be given as $\begin{smallmatrix} 7 & 3 & 1 & 3 & 3 \\ 3 & 1 & 3 & 3 \end{smallmatrix}$. The upper incisors were most doubtful, and they remain so, as this region is lacking in No. 21709. There is a large caniniform tooth preceded and followed by diastemata and inserted at a point

nearly two-thirds of the distance from the anterior end of the premaxilla to its suture with the maxilla. This must be an incisor, and from its position is probably not I^1 . We indicated the possibility of their being a small I^3 close to the posterior end of the premaxilla and therefore tentatively called the enlarged tooth I^2 . It should, however,

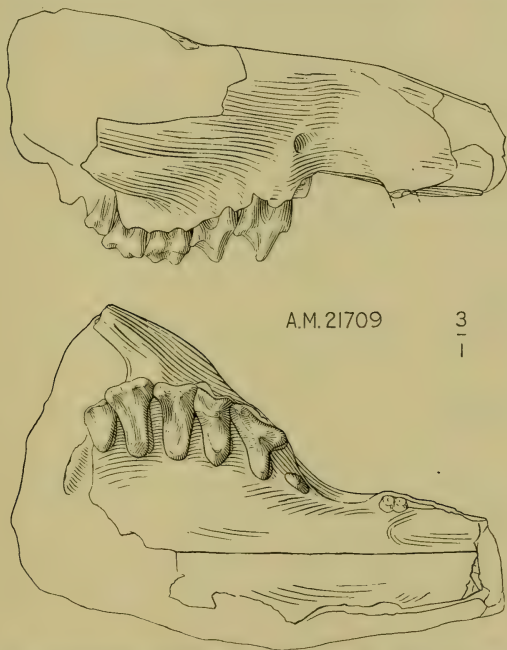


Fig. 1. *Zalambdalestes grangeri*, new species. Right lateral and palatal views of type skull. Three times natural size.

be stated that this region is obscure in the two specimens which show it (21708 and 21704) and that the presence of the tooth called I^3 is not certain. Further discussion would be futile and the only positive fact is the presence of a large lateral caniniform incisor.

CANINE: In the earlier paper the small two-rooted tooth in the middle of the diastema was considered as either P^2 or the canine but

comparison was especially with P^2 of other insectivores. For a canine it is aberrant, although not altogether unique, in its position far back of the maxillo-premaxillary suture. P^2 is now definitely recognized posterior to it, however, so that it must be the canine or P^1 . It is rather small, two-rooted, and relatively posterior, hence much like a premolar, but in the most nearly comparable later mammals P^1 is often lacking, while the canine is never lacking, is often two-rooted, relatively small and premolariform, and is occasionally some distance back of the suture, so that it seems necessary to consider this tooth as the canine.

PREMOLARS: The real P^2 was not previously distinguished, but it is clearly shown in the present skull and, with this help, is now also found to be indicated in the previous material. It is a very small tooth close to P^3 and immediately below the infraorbital foramen. The palate narrows abruptly here and the long axis of the tooth follows the oblique dental border, running anterointernal—posteroexternally. The crown is simple, compressed, with but a single cusp and no cingula.

The five large cheek teeth, although somewhat worn, are better preserved than in any other known Djadokhta mammal and their structure may now be definitely set forth for the first time. Our earlier conjectures are, on the whole, well confirmed.

P^3 has a high, piercing, main cusp surrounded by three lesser cusps. The main cusp is not central, but nearer the external border. Directly anterior to it is the small parastyle, while the metastyle, equal in height to the ps but more distinctly separate from the main body of the tooth, projects posteroexternally as a spur. A similar spur of equal length but somewhat lower projects internally and somewhat anteriorly from the main cusp. This heel-like cusped spur is clearly the equivalent of the protocone of the molars.¹

P^4 is similar to P^3 in structure, but is wider, with the parastyle anteroexternal to the main cusp and the protocone spur larger. This tooth is closely similar to the true molars in form, but is sharply distinguished by the fact that there is only one main external cusp instead of two and that this cusp is somewhat farther from the external border than the paracone and metacone of the molars and larger than either.

¹The Osbornian cusp terms are accepted without reference to theories as to order of development but as morphological terms applicable to molars and molariform premolars alike. This usage is becoming established in the literature and its advantages seem obvious.

M¹ and M² are of the same structure save that M² is wider transversely and has the parastyle the more external instead of the metastyle, as in P³⁻⁴, or instead of having both nearly equally external as in M¹. These teeth are tritubercular but are very short and wide, being more elongate transversely than in any other known insectivore and approached in this respect only by some of the zalambdodonts (cf. *Ericulus*, *Chrysochloris*). The structure, however, is quite different from that of any recent zalambdodont. The paracone and metacone are lateral in position, separated only by the narrow cingulum from the external border of the tooth. They are subequal and are rather more distinct than the earlier material suggested. The bases are to a certain degree confluent, but hardly more so than in *Ictops*, for example. The parastyle and metastyle are small and are united across the outer face of the crown by a narrow cingulum. Internally there is a stout protocone, much worn in this individual but apparently originally not quite as high as the paracone and metacone. The crown between the outer and inner cusps is hollowed out by wear. There is no trace of a hypocone or of an anterior cingulum.

M³ is a small tooth, not so wide in proportion to its length as the preceding molars. The paracone is larger than the metacone and there appears to be no metastyle.

LOWER DENTITION: No new material of the lower dentition has been found and the figures accompanying the earlier paper reveal what is known. A few words must be added to the verbal description. The hypoconulid cannot be distinguished on M₁₋₂ in the available material but in M₃, as mentioned, it is distinct and close to the entoconid. The paraconid is internal on all the molars and is probably slightly lower than the metaconid, although this is not certain. Paraconid and metaconid are closely approximated. On P₄ the paraconid is more distinct and slightly more external, but is lower than on the molars. The heel of P₃ has but a single cusp and seems to slope downward externally.

As seen in No. 21704, P₂ occludes just posterior to the upper canine, hence well in advance of P² and not in contact with it. The



Fig. 2. *Zalambdalestes grangeri*. Diagram of right upper cheek teeth. Arrow follows the main apices of pre-molars and molars. Twice natural size.

tip of P_1 seems to pass just internal to P^2 . A wholly incisiform semi-procumbent tooth, which must be the homologue of the lower canine, passes just anterior to the upper canine and comes lightly in contact with it.

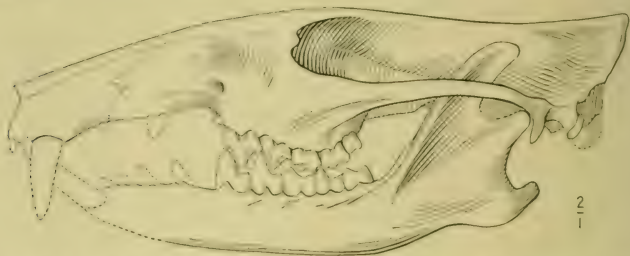


Fig. 3. *Zalambdalestes lechei* Gregory and Simpson. New composite reconstruction of skull and jaws, left lateral view. Twice natural size.

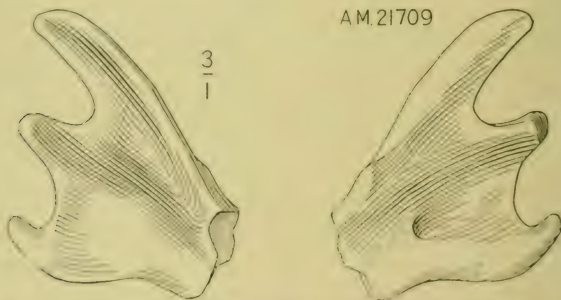


Fig. 4. *Zalambdalestes grangeri*. Posterior part of right lower jaw of type, external and internal views. Three times natural size.

SKULL: The new skull fully confirms our belief that the large opening in the base of the anterior end of the zygoma of No. 21708 is artificial. In the present specimen this region is better preserved and a thin plate of bone is here seen, slightly hollowed out, probably for the origin of well developed snout muscles.

MANDIBLE: In our earlier material the angular process of the mandible was lacking and the coronoid process, while apparently complete, had probably lost its apex. With No. 21709, however, is

associated the completely preserved postdental portion of the right mandible, and the earlier restoration must be modified. The coronoid is long and slender, extending farther back than the condyle. The angle is a small, pointed, hook-like process, not at all inflected. The external surface of the base of the coronoid is excavated. On the internal surface, the region anteroinferior to the condyle is broadly concave and near the anterior end of this shallow excavation is the large dental foramen. Although distinctive, this whole posterior part of the mandible finds fairly close comparison with *Potamogale* among zalambdodonts or with some of the erinaceomorphs, such as *Necrolestes* or *Galerix*.

SKELETAL REMAINS

In the same nodule of reddish sandstone which yielded skull No. 21709 were a number of skeletal fragments. Besides some indeterminate fragments, distal caudal vertebrae, etc., there were found parts of a pelvis and femur and, at a little distance from these, another pelvis nearly complete with the sacrum, anterior caudals, and some limb bones. On further development the second pelvis and associated material proved to belong to a small reptile, but the other pelvis and femur are mammalian and their size and general characters strongly confirm the natural inference that they belong to the same individual as the skull.

PELVIS: The pelvis is clearly of insectivore type, but is rather peculiar in detail. The acetabulum is deep and about one third of it was apparently formed by the pubis, which is lacking. The ischium just back of the acetabulum is a stout bone nearly oval in section. The ilium, which is complete save for a very small portion of the anterior end, is not blade-like or compressed laterally and is triangular in section throughout. The crista lateralis is prominent and divides the lateral aspect of the bone into nearly equal dorsal and ventral portions. The iliopectineal tubercle is well marked, purely ventral in position, and close to the ilio-pubic symphysis. The anteroinferior iliac spine is also quite distinct and is at the posterior end of the crista

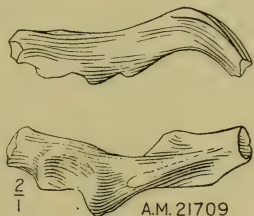


Fig. 5. *Zalambdalestes gran-geri*. Pelvis associated with type. Superior and external views of right ilium and part of ischium. Twice natural size.

lateralis, immediately anterior to the acetabulum. The ventrolateral face of the ilium is concave throughout. The dorsolateral face is convex posteriorly, above the spina anterior inferior ilii and the posterior portion of the crista lateralis, but anteriorly, in the region for the origin of the gluteus medius, it becomes hollowed out. Just at the anterior portion of the sacro-iliac joint the dorsal (or dorsoposterior)



A.M. 21709

Fig. 6. *Zalambdalestes grangeri*. Semidiagrammatic restoration of proximal portion of left femur associated with type. Posterior (ventral) view. Twice natural size.

edge of the ilium is produced into a relatively large plate-like crest, similar to that common in the Creodonta but usually less prominent or absent in the Insectivora. Anterior to this crest and to the sacroiliac joint the ilium turns sharply outward and projects anterolaterally and somewhat upward, free of the vertebral column. This pelvis, basically primitive but with strongly marked muscle insertions and a certain peculiar aspect of its own, suggests a strong pelvic musculature. It is far the oldest mammalian pelvis so far discovered

FEMUR: Only the proximal portion of the femur is preserved and this is imperfect, but can be restored with certainty. It is at a definitely higher evolutionary level than any of the known Jurassic femora and agrees with the rest of the evidence in marking *Zalambdalestes* as a member of the basic true placental stock.

The head projects at an angle to the shaft, but the neck is not markedly constricted. The greater trochanter projects nearly as high as the head, from which it is separated by a very shallow notch. It is compressed transversely, and a strong curving crest runs downward and then internally from it to the lesser trochanter which is large and quite internal in position. Just beneath this crest is the deep digital fossa. The presence or absence of a third trochanter cannot be determined.

MEASUREMENTS

| | <i>Zalambdalestes grangeri</i> No. 21709 | <i>Z. lechei</i> No. 21708 |
|--|---|-------------------------------|
| P ³⁻⁴ ant.-post., ext. | 5.3 mm. | 5.3 mm. |
| M ¹⁻³ a.-p., int. | 5.3 | 4.5 |
| M ¹⁻³ a.-p., ext. | 6.3 | 5.4 |
| P ³ -M ³ a.-p., ext. | 10.8 | ca. 9.9 |
| M ¹ a.-p., ext. | 2.5 | 2.1 |
| M ¹ transverse | 4.1 | 4.0 |
| M ³ a.-p., ext. | 1.7 | ca. 1.4 |
| M ³ trans. | 2.7 | ca. 2.6 |

Measurements of teeth so small and irregular may differ even several percent if taken at different times or by different observers. The above were taken with proportional dividers under a microscope and repeatedly checked and compared. Reasonable allowance has been made when necessary for the more eroded teeth of No. 21708, so that, if anything, the differences between the two are minimized.

Djadochtatherium matthewi Simpson

When the type skull of *Djadochtatherium* was described, preparation of the associated fragments was not complete. Mr. Thomson has since completed his skillful work, revealing several associated foot bones, five fragmentary vertebrae, the lower end of a scapula, a large part of a humerus, ribs, and several other fragments. These were all found in direct association with the skull and jaws and there is every reason to consider them as parts of the same individual. Incomplete as they are, these remains are of great interest and significance and this occasion is taken to describe them in some detail.

The proximal epiphysis and much of the shaft of the right *humerus* are preserved. While it agrees in a general way with the only other multituberculate humerus so far described,¹ that of *Ptilodus*, it differs somewhat in detail and permits a more thorough description of the known parts than that given by Gidley. As he has pointed out, the humerus in this Order is entirely unlike that of the monotremes and stands at the same evolutionary level as that of the most generalized placentals and marsupials.²

The head is large, the articular surface forming part of a sphere and only slightly elongated anteroposteriorly. The tuberosities are

¹Gidley, J. W. 1909. Notes on the Fossil Mammalian Genus *Ptilodus*, etc. Proc. U. S. Nat. Mus., XXXVI, 611-26. Humerus, p. 620.

²Gidley states that it is "eutherian throughout" and with this all would agree if by "eutherian" evolutionary status and not positively indicated relationship were meant. Broom has criticised this statement, apparently overlooking the fact that the term "Eutheria" as originally proposed by Gill included both marsupials and placentals and that Gidley was obviously using the term in this sense.

widely separated and neither is enlarged. The bicipital groove is broad and shallow and merges imperceptibly into the anterodistal face of the shaft. The crest of the lesser tuberosity is moderately prominent and becomes gradually lower and more rounded as it passes distally. The deltoid ridge is, as stated by Gidley for *Ptilodus*, "well developed but not highly specialized." Proximally it bears a triangular flattened surface, about 3 mm. wide near the greater tuberosity and narrowing distally so that the apex of the ridge becomes

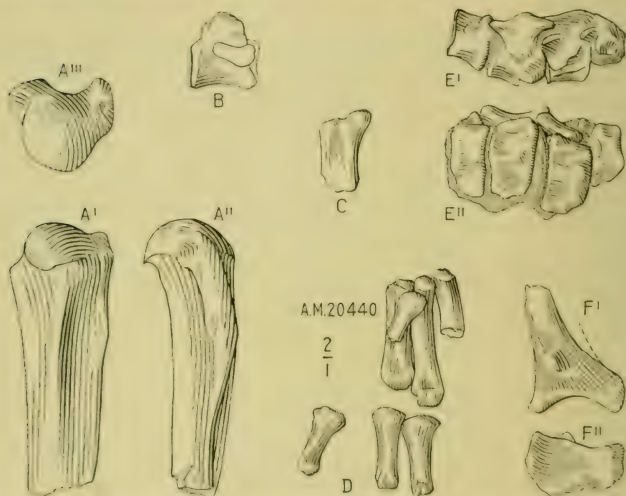


Fig. 7. *Djadochtatherium matthewi* Simpson. Skeletal fragments associated with type. A', right humerus, posterior view. A'', same, external view. A''', same, proximal view. B, Lumbar vertebra, lateral view. C, Head of rib. D, Metacarpals and proximal phalanges, palmar view. E', Articulated dorsal vertebrae, lateral view. E'', same, ventral view. F', Right scapula, lateral view. F'', same, inferior view of glenoid cavity.

single and sharp at a point estimated to be about 15 mm. from the top of the greater tuberosity. About 6 mm. of the ridge is preserved below this point and in this distance, which must carry it well below the middle of the shaft, it becomes only slightly less prominent and remains sharp, bordered by concave surfaces on both sides. There

is also a ridge, quite definite and fairly sharp at first but becoming rounded distally, extending down the posteromedian part of the humerus from below the head to the end of the part preserved. This ridge, the crest of the lesser tuberosity, and the deltoid ridge make the shaft definitely triangular in section, dividing it into a broad, slightly concave anterior face, a narrow concave posteroexternal face, and a still narrower posterointernal face which is concave proximally but becomes somewhat convex distally.

Only a fragment of the right scapula is preserved but it is at present the only multituberculate scapula known and is therefore important. The glenoid cavity is complete, but only a portion of the blade remains. The relationship of glenoid cavity to blade is exactly that of higher mammals and fundamentally unlike that in monotremes. The blade narrowed just above the glenoid and was backwardly directed—another point of marked resemblance to higher mammals and marked dissimilarity to monotremes. The glenoid cavity is elongate anteroposteriorly and somewhat wider posteriorly. The posteroexternal angle projects slightly and is pointed. The cavity fits the head of the preserved right humerus perfectly, allowance being made for the thin articular cartilage, and confirms their natural association.

The importance of this scapula is that it seems to settle much discussion as to the multituberculate shoulder girdle and agrees with much other evidence in showing that the multituberculates were in at least a metatherian¹ stage of evolution and cannot possibly have been ancestral or closely related to the monotremes. In 1889 Marsh described under the name *Camptomus amplus* a scapula, interclavicle, and other fragments (the association of which with the reptile-like shoulder girdle was admitted to be doubtful). This clearly reptile-like shoulder girdle was considered as probably, or possibly, allotherian (multituberculate)² and as such, without due regard for the hesitation which Marsh himself expressed and for the fact that reptiles to which parts of this dissociated shoulder girdle could well belong are known to occur in the same formation, it has become firmly fixed in the literature, popular and scientific. Thus Broom cites it in the course of his valuable discussion of multituberculate affinities.³ Broom also believed the pectoral girdle to be known in *Ptilodus*, so identifying the

¹This does not mean that they were related to the Marsupialia.

²Marsh, O. C. 1889. Discovery of Cretaceous Mammalia. Am. Jour. Sci., (3) XXXVIII, 81-92. *Camptomus*, p. 87.

³Broom, R. 1914. On the Structure and Affinities of the Multituberculata. Bul. Am. Mus. Nat. Hist., XXXIII, 115-134. *Camptomus*, p. 125.

element called the pelvis by Gidley.¹ Further discoveries quickly showed that Gidley was correct with regard to *Ptilodus*.² and the present specimen shows that Marsh and those who have followed him were probably incorrect in referring the *Camptomus* fragments to a multituberculate. *Djadochtherium* is a typical multituberculate, older than the Lance, whence *Camptomus* was derived, and it certainly can have had neither reptile-like coracoid nor interclavicle, although of course rudiments of the more typically reptilian elements may have been present as they are in many primitive marsupials and placentals.

The preserved foot bones probably belong to the right manus and consist of four *metacarpals*, two of them complete, and three proximal *phalanges*. The proportions and general aspect of these bones are quite comparable to those familiar in primitive marsupials and placentals. Metacarpal II is 9.1 mm. long; Met. III, 10.8 mm.: 1st phalanx II, 6.9 mm.; 1st phal. III, about 7.0 mm. The middle portion of the shaft of met. III measures 2.0 mm. in transverse diameter. The bases of metacarpals II and III are closely appressed, somewhat narrowed transversely, and the articular surfaces for the carpals are nearly featureless, approaching simple sections of transverse cylinders and extending, at least on met. II, somewhat farther on the dorsal than on the volar side. The external overlap of the proximal ends common in primitive mammals is either very slight or absent. The shafts of these bones are gently arched, their dorsal surfaces nearly straight and volar surfaces slightly concave. The heads (distal ends) are very little expanded. The surfaces for the phalanges are also transversely cylindrical and extend farther on the volar than on the dorsal side. Keels are absent or, possibly, very faintly indicated at the volar end of the articular surface.

The proximal end of met. I lies in the specimen below that of met. II. Its base is more equidimensional, the carpal articulation rounded. The shape of this surface, the absence of any evidence of pressure against met. II, and its displacement in a foot which was articulated when buried all point to the first digit as being more freely movable than the others and very probably opposable to them.

The first phalanges are expanded proximally and the articular surfaces for the metacarpals are simple and only slightly concave. The distal ends are slender and not expanded. The articular surfaces

¹Gidley, *loc. cit. sup.*, p. 621.

²Note by Walter Grainger to Broom's paper, *loc. cit.*, p. 134.

for the second phalanges also extend farther on the volar side and each has a shallow median groove ending in a slight notch at this end.

These foot fragments definitely suggest a mobile, slender forefoot with an opposable pollex.

The vertebrae include four partial anterior dorsals in articulation and a single isolated vertebra of different character. These are all poorly preserved and their description provisional. The centra of the four associated vertebrae are depressed and are wider than long. On the second and third of the four there is a small posteromedian process on the lower part of the centrum and also small posterolateral processes. These all appear to be absent on the first preserved vertebra and this region is broken off on the fourth. There appear to be no true transverse processes. The nerves probably issued through posterior notches in the bases of the neural arches. The zygapophyses are simple, their articular faces plane and nearly horizontal, but facing a little outward on the post- and inward on the prezygapophyses. The upper parts of the neural arches are broken off. The isolated vertebra, which was found in the same nodule, has a higher and narrower centrum, slightly longer than broad, concave and slightly keeled on the lower surface, and has strong transverse processes. On the four articulated vertebrae facets for ribs appear to be present, although not clear, and two ribs were found very close to them, but there are no rib facets on the isolated vertebra, which must be a lumbar.

The ribs are exemplified by numerous fragments, showing little beyond the fact that capitulum and tuberculum are distinct, close together but separated by a notch, and that the main body of the rib is compressed anteroposteriorly and elliptical in section.

Corrections for Novitates No. 225

This occasion is taken to correct the following errors in our former paper, *Novitates No. 225*.

p. 1, l. 14 & l. 20. For "1924" read "1923."

p. 1, l. 22. Delete "and family."

p. 4, l. 10 of legend to Fig. 1. Insert "H," before "H".

p. 9, legend to Fig. 8. For " $x1/1$ " read " $x2/1$."

p. 9, l. 18-19. Read "The palate is of comparable width throughout internal to the alveoli," etc.

p. 9, l. 2 from bottom. For " P^{2-4} " read " P_{2-4} "

p. 14, l. 21. After " $P_{\frac{3}{2}}$ or 2 " insert " $M_{\frac{3}{2}}$."

- p. 15, legend to Fig. 13. For " $x_{2/1}$ " read "x slightly less than $2/1$."
- p. 16, legend to Fig. 14. For " $x_{2/1}$ " read " $x_{3/2}$."
- p. 17, 1.8. For " P_4 " read " P_3 ."
- p. 17, 1.9. For " P_4 " read " P_4 ."
- p. 20, Fig. 19. The left view is of the internal aspect and would be correctly oriented if rotated clockwise about 150° .

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AFFINITIES OF THE MONGOLIAN CRETACEOUS INSECTIVORES¹

BY GEORGE GAYLORD SIMPSON

The unique series of Mesozoic mammal remains found by the Third Asiatic Expedition in Mongolia has now been completely described in a series of three papers.² The affinities of the one known multituberculate, *Djadochtatherium matthewi*, were as thoroughly discussed as the material warrants in the first paper, and no additional remarks seem necessary. The relationships of the more important insectivores, however, were only briefly discussed in the second paper and a review of the evidence, especially including the important new details given in the third paper, suggests some modification and amplification of the views already presented.

Not only are these mammal remains by far the most complete ever discovered in the Mesozoic, but they also occupy a very strategic position in time and in space which makes close scrutiny of their relationships essential. In time they occur in the Cretaceous, when, according to theories formed before their discovery and based largely on early Tertiary mammals, the differentiation of the placental orders should be in progress and not yet far advanced. In space they occur in Central Asia in or near the region which a number of students, especially Osborn and Matthew, have considered as an important center of radiation and probably the very one whence came the groups of mammals which appear to have entered North America and Europe suddenly at the beginning of the Tertiary and which must have been undergoing an important deployment during upper Cretaceous time. The Mongolian Cretaceous insectivores are thus actual representatives, so long hoped for but so little expected, of a group hitherto hypothetical and known only by its presumed descendants.

¹Publications of the Asiatic Expeditions of the American Museum of Natural History. Contribution No. 85.

²Simpson, G. G. 1925. A Mesozoic Mammal Skull from Mongolia. American Museum Novitates, No. 201.

Gregory, W. K. and Simpson, G. G. 1926. Cretaceous Mammal Skulls from Mongolia. American Museum Novitates, No. 225.

Simpson, G. G. 1928. Further Notes on Mongolian Cretaceous Mammals. American Museum Novitates, No. 329.

These insectivores have been placed in two families, four genera, and five species:

DELTATHERIDIIDAE Gregory and Simpson

Deltatheridium pretrituberculare Gregory and Simpson

Deltatheroides cretacicus Gregory and Simpson

Hyotheridium dobsoni Gregory and Simpson

ZALAMBDALESTIDAE Gregory and Simpson

Zalambdalestes lechei Gregory and Simpson

Zalambdalestes grangeri Simpson

Zalambdalestidae

PARATYPE SKULL OF *Zalambdalestes lechei*:—The classification of the specimens referred to *Z. lechei* is minor relative to the broader relationships here chiefly under consideration, but essential to the taxonomy of the group. In our joint paper Dr. Gregory and I referred to this species, as a paratype, a second nearly complete but badly preserved skull and lower jaws. Space prohibited thorough discussion of the peculiarities of this individual and no explanation of its reference to the same species as the type, of rather different aspect, was given.

The two skulls agree in the following chief particulars: (1) the general shape of brain case and interorbital region is the same; (2) the snout is narrow and elongated; (3) the known features of the lambdoid crest, glenoid and ear regions are the same; (4) so far as known in both, the dental formula is the same; (5) the morphology of the teeth is the same so far as known; (6) the measurements of the teeth are the same so far as accurately obtainable. The paratype (No. 21704) differs from the type (No. 21708) in the following principal particulars: (1) Both cranial and facial regions are shorter, the facial relatively more so; (2) the orbit is larger relative to the skull; (3) the snout is less elongate, the diastemata shorter; (4) the jaw is more slender; (5) the lateral incisor may be smaller, but this is uncertain.

In weighing these resemblances and differences it will at once be seen that the resemblances are those upon which valid taxonomic conclusions are usually based, while the differences are without exception just such as are often seen between the young and the adult of the same species. It is true that the material is imperfect and that further discoveries may indicate specific separation, but this seems improbable. It is a sounder practice to refer specimens to the same species when they cannot be proven to be distinct on the basis of known homologous parts than to create separate species for them because they cannot be rigidly proven to be the same.

EVIDENCE OF THE DENTITION.—Gregory and Simpson provisionally considered the *Zalambdalestidae* as ancestral to zalambdodont insectivores, although clearly stating that the paracone and metacone are more separate and more buccal than in any undoubted zalambdodonts and that the skull is almost devoid of the peculiarly zalambdodont specializations. We considered the separation of the two phyla represented by the Cretaceous families to be slight and emphasized (p. 14) the many resemblances of the *Zalambdalestidae* to the *Leptictidae*, suggesting that the zalambdodont and leptictid groups were possibly not yet distinct. Largely on the basis of a much improved knowledge of the details of molar structure, it now seems more probable that the zalambdodont and leptictid lines were distinct at this time and that *Zalambdalestes* stands closer to the latter, while the true zalambdodonts were derived from a group closer to the *Deltatheridiidae*.

Most of the characters of *Zalambdalestes* fall into four different categories: (1) primitive characters; (2) points of special resemblance to the zalambdodonts; (3) points of special resemblance to the leptictids; (4) specializations peculiar to the genus or family. The main conclusion here drawn is that the third of these categories is more indicative of true affinities than the second.

The anterior part of the dentition is the most highly specialized. The long diastemata and the enlarged lateral upper and median lower incisors are specializations of definitely insectivore character but not leading to any one group of later Insectivora, indeed excluding this genus from direct ancestry of any known later form. The relatively small two-rooted upper and incisiform lower canines are possibly primitive, but they do resemble those of some zalambdodonts (cf. *Limnogale*, *Microgale*, *Potamogale*) although not very closely. The absence of P_1^1 points in the same direction, although this again is a specialization so common and so readily acquired as to afford no really good evidence. These teeth are absent in all zalambdodonts and are also absent in the *Erinaceinae*, but are present in the *Gymnurinae* and in the *Leptictidae*, save *Acmeodon*. P^2 is a small tooth of purely primitive character.

P^{3-4} are becoming molariform. Each has a protocone, parastyle and meta-style, but a single undivided cusp represents both paracone and metacone. The closest analogy, although not exact, is seen in *Potamogale*, but here we begin to encounter difficulties in the comparison with undoubted zalambdodonts, for in the very ancient and primitive *Palaeoryctes* (cf. also *Limnogale*) P^3 is definitely more primitive and the chief cusp of P^4 is more central, as in *Potamogale*. In all other zalambdodonts this cusp is almost or quite internal. P^3 of the Cretaceous genus is also more molariform than in *Leptictis*, but the conditions in this Oligocene form may be secondary for the earlier forms of the same family approach *Zalambdalestes* as closely as does *Potamogale*. P^4 in the leptictids always has the paracone and metacone distinct so far as known, but the conditions in the much older *Zalambdalestes* could readily give rise to those in the leptictids.

The crucial evidence of the molars continues this confusing resemblance to two groups now widely separate, but points much more definitely toward the erinaceomorphs. The molars are short and wide, and in badly worn teeth, such

as the only ones available when the joint paper was written, the resemblance to zalambdodonts is compelling. The structure revealed in *Zalambdalestes grangeri*, however, changes this. It is impossible to consider these teeth as structurally similar to those of such genera as *Ericulus*, *Centetes*, *Solenodon*, or *Chryschloris*, before the upgrowth of the internal cingulum. Not only would this oppose the view, so strongly supported by comparative anatomy, embryology, and paleontology, that this cingulum is vestigial, not rudimentary,¹ but it is strongly contradicted by the actual morphology of the teeth in question. With their two large buccal cusps and strong cingulum external to these, the teeth of *Zalambdalestes* are obviously closer to those of *Palaeoryctes* or of *Potamogale* than to any other zalambdodonts. But even here the morphological gap is large, for in these two genera the paracone and metacone are median and nearly confluent and the external shelf is wide, with strong styles, while in the Cretaceous genus paracone and metacone are quite distinct and buccal, while the external shelf is represented only by a strong but narrow cingulum and the styles are vestigial.

On the other hand, the molars of *Zalambdalestes* are almost identical with those of the leptictids in ground plan. They differ only in being shorter, more transverse, without hypocone or anterior cingulum. The absence of these two features of the later leptictid molars is primitive and the more transverse development, not in any event a fundamental difference, is approached by such leptictids as *Palaeolestes* and *Gypsonictops*. The molars of *Zalambdalestes grangeri* are longer than those of *Z. lechei*, furthermore, and the differences from the leptictidae are really slight. The small M^3 also resembles the homologous tooth in leptictids closely and is quite unlike that of any true zalambdodont.

The lower cheek teeth confirm the evidence of the uppers. P_{3-4} are strikingly leptictid in general character, P_4 being quite as molariform as in many leptictids. Nor does any character of the lower molars exclude them from the structural ancestry of the latter. The only approach to zalambdodont structure lies in the short trigonids, but this is not very distinctive, is simply complementary to the short upper molars, and is not, as invariably in zalambdodonts, accompanied by a shortening of the heels. *Palaeoryctes* and *Potamogale* are the most primitive zalambdodonts in this respect, as in other dental characters, but in neither is the heel structure like that of *Zalambdalestes* and in both the high trigonid towering above the small, low heel is quite unlike the condition seen in *Zalambdalestes* and in the Leptictidae.

OSTEOLOGICAL EVIDENCE.—Turning to the skull and jaws, the evidence tends in the same direction as that of the dentition. The resemblances to the Zalambdodontia are largely those in which this group most

¹This problem is much too large to discuss here. Valuable discussions with references to the most important literature will be found in the following studies:

Gregory, W. K. 1922. *The Origin and Evolution of the Human Dentition*. Baltimore. Esp. p. 101-107.

Leche, W. 1907. *Zur Entwicklungsgeschichte des Zahnsystems der Säugetiere*, etc. 2ter Teil, 2ter Heft: die Familien der Centetidae, Solenodontidae, und Chryschloridae. Chun's Zoologische, XLIX. (This work contains a great wealth of information on zalambdodonts and to it and to Leche's other papers on Insectivora the writer is deeply indebted.)

Matthew, W. D. 1913. A Zalambdodont Insectivore from the Basal Eocene. *Bul. A. M. N. H.*, XXII, 367-41. (Full description of *Palaeoryctes*, to which reference is frequently made in the present paper.)

approaches the primitive conditions for all insectivores. The basicranial structure is poorly known but, as already pointed out by Gregory and

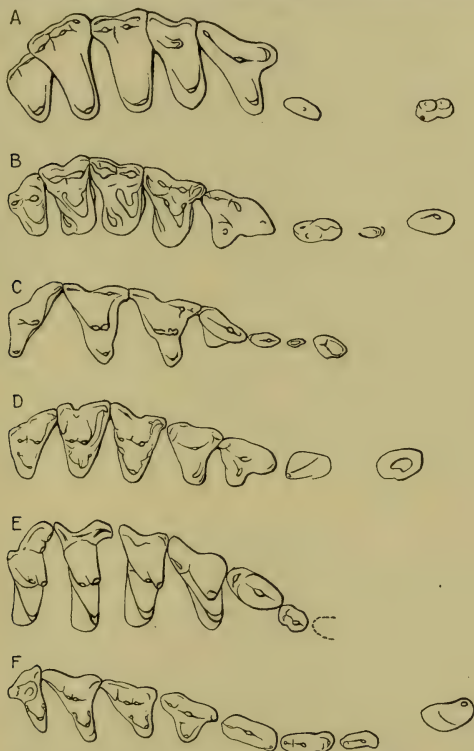


Fig. 1. Comparative diagrams of right upper cheek. A, *Zalambdalestes grangeri*. B, *Diacodon bicuspis*. C, *Deltatheridium pretrituberculare*. D, *Didelphodus absarokae*. E, *Palaeoryctes puericensis*. F, *Sinopa strenua*. Not to scale. Drawn by John Germann.

Simpson, is devoid of characteristically zalambdodont characters so far as can be determined. The complete zygomata and unfused nasals are, of course, primitive, but the loss of these characters was a very early and universal specialization of zalambdodonts. The general

aspect of the skull is somewhat like some zalambdodonts (although the postorbital constriction is slight or lacking in the latter) but is equally, or rather more, like some leptictids (cf. *Diacodon*, for example) and really furnishes no convincing evidence of affinities beyond strongly confirming reference to the Insectivora.¹

The posterior region of the lower jaw with its hook-like, non-inflected angle and long slender coronoid also is a slight modification of a type occurring in most groups of insectivores. The femur is more like that of *Ictops* than of any known zalambdodont, but is too generalized to cast much light on the problem.

The pelvis also is primitive in general features, suggesting the basic type seen with many variations in the Insectivora and retained in modified form in many other primitive placentals. The resemblance of this pelvis to that of some creodonts, such as *Tritemnodon*, is marked, but in the latter forms the crista lateralis is generally more ventral and the ventrolateral surface of the ilium reduced. The pelvis is not exactly like that of any other known insectivore. The probable participation of the pubis in the acetabulum rim and the median crista lateralis distinguish it from that of any soricid or talpid and the strong development of the gluteus medius area differs sharply from any zalambdodont. The position of crista lateralis, of the spina anterior inferior ilii, and of the tuberculum iliopectineum are all paralleled in the leptictids and the expanded anterosuperior plate of the ilium and its outward extension anteriorly are largely due to greater emphasis of characters also occurring in less extreme form in erinaceomorphs. The fact that this modification is very like that seen in some creodonts is interesting but is probably not indicative of special affinity.

Deltatheridiidae

The characteristic members of this family are *Deltatheridium* and *Deltatheroides*, two closely related genera which differ chiefly in that in the former P^1 is lacking, P^2 is one rooted, P^3 is shorter than P^1 , and P^4 has only a slight basal internal heel, while in the latter P^1 is present, P^2 two-rooted, P^3 as long as P^1 , and P^4 has a distinct internal heel. Unfortunately *Deltatheroides*, in some respects the more interesting, is less adequately known, but its general structure was probably close to that of the other genus. *Hypotheridium* was referred to the family doubtfully; it is sharply distinct in its slender elongate snout, and the cheek tooth structure is very little known so that its true relationships are open to question.

Gregory and Simpson considered this family as structurally "in a very central position, ancestral to the creodonts and to many or all

¹The reference of the Zalambdalestidae to the Insectivora does not rest largely on primitive characters, as in so many supposed Eocene insectivores or as in the Deltatheridiidae, but on numerous positive resemblances to unclassified insectivores. It hardly appears necessary to debate this point, but Pfeffer, in a recent study (Pfeffer, G. 1927. Die Frage d. Grenzbestimmung zwischen Kreide und Tertiär in zoogeographischen Betrachtung. Jena), denies that they are even placentals, suggesting that they are an extinct group of strepsirrhines from the Pantotheria. Without wishing to slight Dr. Pfeffer's elaborate and valuable summaries of much other material, the main thesis of his paper may be said to be that the placentals suddenly came into being at the beginning of the Tertiary, which is supposed to be chiefly delimited by this event. Rather than recognizing that the Mongolian mammals put the last nail in the coffin of this theory, moribund for fifty years, and on no evidence save that they refute his arguments, Pfeffer gives these mammals a position absolutely opposed by every feature of their anatomy.

of the dilambdodont insectivores and possibly also to other orders." Reconsideration enlarges and strengthens the main points of this view and adds the suggestion that divergence from the zalambdodonts is really less in this family than in the Zalambdalestidae.

RELATIONSHIP TO DIDELPHODUS.—It was also suggested that *Didelphodus*, of the American lower Eocene, might belong to this family. *Didelphodus* differs from *Deltatheroides* in the absence of P^1 , from *Deltatheridium* in the larger 2-rooted P^2 and submolariform P^4 , and from both Cretaceous genera in the heeled P^3 and more distinct paracone and metacone of the molars. Except for these points, which indicate merely that *Didelphodus* is more advanced than either of the earlier genera, the upper teeth are very closely similar. The lower teeth of *Deltatheroides* are unknown. *Didelphodus* differs from *Deltatheridium* in the lower dentition by the presence of P_1 , the stouter and more complex P_{3-4} , the slightly wider molar heels, the shorter trigonid on M_1 , the smaller paraconids, and the shorter heel on M_3 . The absence of P_1 and long heel of M_3 are certainly specializations in *Deltatheridium* and they exclude it from the direct ancestry of *Didelphodus*, although not profound differences. The heel is narrow in both, although more so in the Cretaceous form, and it is impossible to say which is the more primitive condition. The same is true of the relative sizes of paraconids and metaconids. The genera appear to be related, although showing incipient specialization along slightly divergent lines. *Deltatheroides* has no known character excluding it from the ancestry of *Didelphodus*, but is insufficiently known for a positive conclusion on this point.

The reference of *Didelphodus* to the Deltatheridiidae seems warranted by the facts in hand and is convenient. It has been referred to the Leptictidae, both as a creodont and as an insectivore, and also to the Proviverridae, but its resemblances are not at all close to either family.¹ *Phenacops*, from the middle Eocene, is apparently related to *Didelphodus*.² It is known only from an imperfect lower jaw, but is

¹Despite its name, *Didelphodus* has nothing to do with the marsupials. On this genus see especially:

Cope, E. D. 1881. The Temporary Dentition of a New Creodont. *Am. Nat.*, XV, 667-9. (Here referred to *Deltatherium*.)

" . . . 1882. Notes on Eocene Mammalia. *Am. Nat.*, XVI, 522.

" . . . 1885. Tertiary Vertebrata. *Rept. U. S. Geol. Surv. Ter.* (Hayden), III, 284.

Matthew, W. D. 1918. Insectivora, etc., in Matthew & Granger, A Revision of the Lower Eocene Wasatch and Wind River Faunas. *Bul. A. M. N. H.*, XXXVIII, 579-85.

Scott, W. B. 1892. A Revision of the North American Creodonta, etc. *Proc. Ac. Nat. Sci. Phila.*, 1892, 311.

²Matthew, W. D. 1909. The Carnivora and Insectivora of the Bridger Basin. *Mem. A. M. N. H.*, IX, 535-6.

" . . . 1918, loc. cit., p. 582.

interesting as having P_1 reduced and the heel of M_3 very narrow and long—convergences toward *Deltatheridium*.

Aside from these two Eocene genera, there appear to be no other mammals which show special affinity with the Deltatheridiidae and none with which generic comparison is necessary.

RELATIONSHIP TO ZALAMBODONTS AND CREODONTS.—Turning to the broader aspects of the problem, *Deltatheridium*, *Deltatheroides*, probably *Hyotheridium*, and apparently also *Didelphodus* and *Phenacops* form a group of distinct genera which may be provisionally united into a single family. The characters of this family suggest closer comparison especially with zalambdodont insectivores and with creodonts, two ancient and primitive groups widely divergent in their more specialized members.

Matthew (1913, loc. cit.) was the first to point out the resemblances between the molars of *Didelphodus* and those of the zalambdodonts and to suggest that this genus, which he referred to the Leptictidae but which then occupied a position apart from any other known form, might afford a clue to the origin of the peculiar teeth of this division of the Insectivora.

Structurally, the family Deltatheridiidae does offer an almost ideal point of departure for the zalambdodonts. The molars are not unlike those of *Potamogale*, still closer to those of *Palaeoryctes*. The high trigonids and low narrow talonids are as typical of the ancestral zalambdodont condition as of the more central carnivores. The premolars are less specialized than in any known zalambdodont and could give rise to the conditions in the latter. The upper molars with their wide external shelves and central, almost connate paracone and metacone are also closer to those of *Palaeoryctes* than are those of any other known mammal not definitely a zalambdodont. There are no specializations sufficiently profound to exclude the family, as a broad unit, from a position very close to the ancestry of the zalambdodonts.

Nevertheless there is reason to believe that the known members are advancing more in the direction of the Carnivora. Their departure from a primitive, very central position is slight but seems to indicate that their phylum lay closer to the creodont line than to any other arising at this time. The canines are much enlarged and single-rooted, the molars do not tend to shorten but seem to be approaching such types as *Procyon*, *Deltatherium*, and others, the talonids are

narrow but are not short and that of M_3 is unusually long—a specialization independent from the similar one which appears in some later carnivores but nevertheless of creodont type and directly opposed to the tendencies which gave rise to the zalambdodonts. It is conceivable that *Hyotheridium* is closer to the zalambdodonts than are the typical genera, but too little is known of it. The creodont and zalambdodont lines may tentatively be visualized as diverging at a time somewhat earlier than that of the Djadokhta Formation and the Deltatheridiidae as arising in or near the base of a focal Asiatic proto-creodont group, within the order Insectivora.

BROADER RELATIONSHIPS

These relationships, while inevitably subject to radical revision when other discoveries make advances possible, do rest on resemblances of a definite sort. Beyond them are other broader and less definite but not less important inferences which may be stated without too much insistence. The structure of the deltatheridiids agrees with their position in time between the pre-placental, pre-marsupial pantotheres and the close but distinct array of placental orders in the early Tertiary and with their position in space near the center of the land masses later dominated by placentals in suggesting that they, of all known mammals, stand closest to the common point of divergence of many or all placental mammals. In the skull and dentition they come very near to showing all the features which the most competent students of Paleocene and early Tertiary mammals have believed would characterize such a central group when found.

Of the important characters of the family as a whole, only one is unexpected or could be considered as widely aberrant, namely, the great width of the shelf external to the paracone and metacone, but this feature also, while possibly more highly developed in this particular line than in some others then diverging from the insectivorous proto-placentals, is apparently to be considered as primitive.

Winge, in an early and important paper on molar evolution, long ago suggested that the external styles and cingulum of the upper molar are extremely ancient structures.¹ For his extreme view that they are the *most* ancient part of the tooth there seems no real evidence and a vast body of facts now opposes it, but more and more items of evidence, of which these Cretaceous mammals are not the least, are

¹Winge, H. 1882. Om Pattedyrenes Tandskifte, etc. Vidensk. Meddel. f.d. naturh. Foren. i Kjöbenhavn, 1882, p. 15-69.

appearing to demand a greater antiquity and importance for the part of the upper molar external to the paracone and metacone than has been commonly granted. In the most primitive living mammals and in the majority of the early Tertiary forms the upper molars usually have a strong external shelf, in some cases, which may offer a real clue to the whole process, agreeing with the *Deltatheridiidae* in occupying nearly half the total width. Not only is such a structure seen in ancient and primitive *zalambdodonts*, but also relatively little modified in many *creodonts*, which are the most primitive and central members of a group including *carnivores* and *ungulates* and related to the ancestry of other orders. The *soricoids* and *bats* also have a specialized molar structure which could be derived from that of the *Deltatheridiidae* by wider separation of paracone and metacone, their acquisition of a *lambdoid* shape, and the upgrowth of a *hypocone*. In the more primitive members of many groups of mammals the paracone and metacone are not really external and there appears to be no real evidence that in these groups they have migrated inward from a strictly buccal position.

It is not to be assumed that no new styles have arisen, or that all which occupy analogous positions are homologous. It is suggested only that the ancestral condition, the condition in the Cretaceous insectivores which gave rise to all higher mammals, was near that of the *Deltatheridiidae*, with a large bifid central cusp, an internal heel, and a more or less broad external cingulum or shelf. These are probably the only elements which were present in the common ancestry and which are strictly homologous (when correctly identified, of course) throughout all placentals. Within each line of descent the teeth went their own way, *hypocones* (not really homologous in the different orders), *conules*, *styles*, supplementary cusps arose or were lost, paracone and metacone became more distinct (most mammals) or fused (*zalambdodonts* and some *carnivores*), *premolars* became molarized by steps which followed the general history of the molars but, since they started from a different basis, could not be expected to recapitulate the exact history. But enough has been said on this very complex subject, to which the writer hopes to return in more detail, to indicate its probable bearing on the immediate question.

CONCLUSIONS

1. The Zalambdalestidae and Deltatheridiidae are not widely different but are related to diverging groups.

2. The Zalambdalestidae are the more specialized and, contrary to the opinion first expressed, are more distant from the zalambdodonts than are the members of the other family.

3. The closest affinities of the Zalambdalestidae are with the erinaceomorphs, of which group they represent a very early and non-ancestral branch.

4. The Deltatheridiidae are on a very primitive plane and show but little specialization from a condition structurally ancestral to the majority of placental mammals.

5. Such specialization as they do show is tending in the creodont direction and they strongly suggest the hitherto hypothetical group of Cretaceous insectivores inferred, especially by Matthew, to be the immediate ancestors of the Carnivora.

6. The evidence further suggests that the zalambdodont insectivores had their origin very near this group, although probably not specifically in the family Deltatheridiidae.

7. Both Zalambdalestidae and Deltatheridiidae, although on a very low evolutionary level, are definitely placentals and Insectivora and a break still remains between them and the Jurassic pantotheres, a break which is not profound and which can now be filled by inference more surely than before but which is not actually bridged by any known mammals.

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PALEOCENE MULTITUBERCULATES FROM MONGOLIA¹

BY W. D. MATTHEW, WALTER GRANGER, AND
GEORGE GAYLORD SIMPSON

In 1925 Matthew and Granger² described as *Prionessus lucifer* the lower jaw, without teeth, of a small multituberculate. This specimen, collected in 1923, is from the Gashato Formation which was referred to the Paleocene—a reference rendered still more probable by later discoveries. In 1925 further collections were made, including the specimens of multituberculates here described.

Prionessus lucifer Matthew and Granger, 1925

New material of this species consists of a lower jaw with broken M_1 and complete but worn M_2 (A. M. No. 21710), a palate with all of the molars (A. M. No. 21717), and some isolated teeth and fragments (A. M. No. 21724). As is generally the case in the later multituberculates, M_1 is narrower and longer than M_2 . The tooth is too worn and broken for an accurate count, but the cusp number was relatively small, possibly about five outer and four inner cusps. M_2 is subtriangular, with three outer and two inner cusps, giving the formula 3:2. The cusps are large, rather quadrate, relatively simple. The two posterior cusps of the outer row are imperfectly separated at their bases.

In the upper jaw there is a single premolar root immediately anterior to M^1 . The specimen is broken anterior to this point, but the reduction of the single lower premolar suggests a similar condition in the upper jaw, as in *Tæniolabis* ("Polymastodon"). The cusp formula of M^1 appears to be 6:7:5. Outer and middle rows are of approximately the same length, but the latter has the greater width. The inner row narrows and becomes ridge-like anteriorly and does not quite reach the anterior end of the tooth. The cusps are simple, with no definite indication of the secondary furrows and ridges characteristic of most American Cretaceous and Paleocene multituberculates, although these may have been removed by wear. M^2 is about as wide and long, and like the opposing lower tooth is subtriangular, but with the shortest

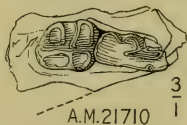


Fig. 1. *Prionessus lucifer* Matthew and Granger. Part of right lower jaw with M_{1-2} , A. M. No. 21710. Crown view, three times natural size.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 86.

²Amer. Mus. Novitates, No. 189.

cuspid-row external. The external row is represented by a single cusp, rounded externally, concave on its inner or median surface. From its apex a ridge passes anterointernally to form a cusp-like wall at the anterior end of the mid-row. Posterior to this, in this row, are two large cusps. The inner row consists of three large nearly conical cusps. The formula may be written 1:3:3, although the anteromedian cusp is obscure.

The palate itself is crushed, but some character can be made out. The posterior (palatine?) portion is pierced by several irregular foramina, but there do not appear to be any true palatal vacuities between the molars or posterior premolars.¹

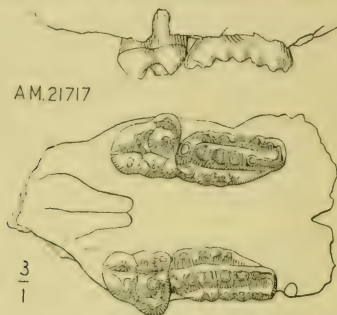


Fig. 2. *Prionessus lucifer* Matthew and Granger. Part of skull with all molars, A. M. No. 21717. Palatal and partial right lateral views, three times natural size.

The choanae are rather narrow and extend forward to a point about opposite the middle of M^2 . The anterior root of the zygoma appears to have been just anterior to M^1 , which, on comparison with *Ptilodus* and *Taniolabis*, agrees with the other indications of an abbreviated ante-molar region in *Prionessus*.

*Sphenopsalis*² *nobilis*, new genus and species

TYPE.—A. M. No. 21736, an isolated left M^2 . Collected in 1925.

HORIZON AND LOCALITY.—Gashato Formation at Shabarakh Usu, Mongolia.

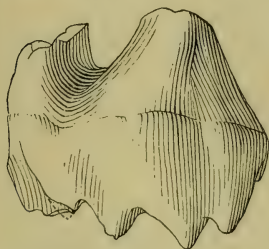
DIAGNOSIS.—Cusp formula of M^2 1:2:4. This tooth nearly as large as in *Taniolabis taocensis*, width 11.0 mm., length about 14 mm. Single outer cusp an antero-internal-posteroexternal crest, almost wholly anterior to the outer part of the antero-median cusp. The latter developed as a large, oblique, curved crest beginning at the midpoint of the anterior border and rising to an apex near the midpoint of the external border. Immediately posterior to this, another cusp nearly parallel to it and of similar character but slightly smaller and more transverse. The inner

¹Vacuities are present in *Ptilodus*. Broom reported them in *Taniolabis*, but restudy suggests that they are absent in this genus.

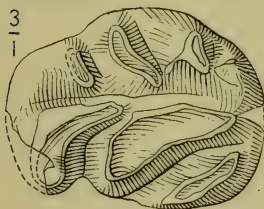
²*σφήνη*, wedge, *ψαλίς*, scissors, in allusion to the cuneiform shearing cusps and suggestive of its ally *Catopsalis*.

cusps row consisting of four cusps, the second and third the longest, their bases united internally, apices along the internal margin, the posterior three somewhat produced into crests which run anteroexternally.

In addition to the type, there are several fragments of teeth apparently of this genus. One (A. M. No. 21715) is the anterior end of a first lower molar, perhaps of the left side. It indicates a width for this tooth of seven or eight millimeters. The cusps are in two rows and are simple, without secondary ridging or grooving, and like those of M^2 are produced into oblique crests, those of the external row

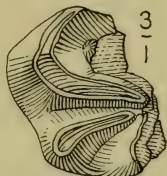


A.M. 21736



A.M. 21715

Fig. 4. *Sphenopsalis nobilis* Matthew, Granger, and Simpson. Anterior end of M_1 , A. M. No. 21715. Crown view, three times natural size.



A.M. 21713

Fig. 5. *Sphenopsalis nobilis* Matthew, Granger, and Simpson. Anterior end of left M_2 , A. M. No. 21713. Crown view, three times natural size.

Fig. 3. *Sphenopsalis nobilis* Matthew, Granger, and Simpson, new genus and species. Type, left M^2 , A. M. No. 21736. Internal and crown views, three times natural size.

running posterointernally, those of the internal row posteroexternally. Anterior to one of the rows (probably the external, if analogies are not misleading) is a small thorn-like accessory cusp. From its small size it is not certain that this tooth belongs in this species—it is slightly narrower relative to M^2 than is M_1 of *Tæniolabis*—but the structure is harmonious, and the size difference not unduly great.

Among other fragments is the anterior end of a left M_2 which, from its character and perfect occlusion with the type, surely belongs to this species. The anterointernal cusp is large, high, very strongly and perfectly crescentic, the wings of the crescents pointing backwards. The outer row is only about half as wide as this cusp. The anteroexternal cusp and part of that following are preserved. The former, at least, was like the cusps of the M_1 described above, with an external

apex and a sharp crest running posterointernally. The total width anteriorly is 10.6 mm.—exactly the same as in some specimens of *Taniolabis taënsis*.

The dentition, so far as revealed, is certainly multituberculate but of an adaptive type very different from that of any other known genus. The high, narrow, sharp crests of the cusps are little fitted for heavy crushing or grinding but form a cutting device of remarkable perfection, probably an adaptation to some specific type of vegetable food.

AFFINITIES OF *PRIONESSUS* AND *SPHENOPSALIS*

Matthew and Granger (Op. cit., 1925, p. 6-7) compared *Prionessus* with *Catopsalis*, *Meniscoëssus*, and *Taniolabis* rather than with the *Ptilodus* group, which it more resembles in size, and suggested that it might be "an ancestral type of the catopsaline subfamily." The present more complete data are still inadequate for final decision, but they tend to support this view. The large, stout lower incisor¹ (not strongly compressed as in *Eucosmodon*), the absence of P_3 and the greatly reduced P_4 , the simple cusps and their number (close to *Catopsalis* in at least the lower jaw), the probably short broad muzzle, and the absence of palatal vacuities (which we believe also to have been absent in *Taniolabis*) all suggest relationship to this group rather than to the true Ptilodontidæ. The difference in size is striking but, as regards family relationships, unimportant.

Sphenopsalis is as yet morphologically unique and this, with the inadequacy of the known material, makes its relationships still more doubtful. It also, however, may tentatively be considered as related to *Catopsalis* and *Taniolabis* more closely than to other previously known genera. The adaptative type is very different from that of *Taniolabis*, with its broad crushing teeth², but *Catopsalis* is somewhat intermediate in adaptation. The molars of *Taniolabis* have many points in common with those of *Sphenopsalis* so far as the latter are known. In the American form the cusps have apparently become heavier and more quadrate, in the Mongolian more compressed and crested, but it is a tenable hypothesis that these represent divergent adaptations from a more or less intermediate ancestral type, perhaps more nearly preserved in the Mongolian *Prionessus* and, probably to less extent, in the American *Catopsalis*.

¹Known only from its alveolus.

²Less different, however, than would be supposed from the literature, for the unworn molar cusps of *Taniolabis* are high, crested, and rather slender.

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FOUR NEW FROGS FROM FUKIEN PROVINCE, CHINA

CLIFFORD H. POPE

In this paper I describe four new frogs collected by myself, in Fukien Province, for the Third Asiatic Expedition of The American Museum of Natural History, during 1925 and 1926.

Megalophrys kuatunensis, new species

TYPE.—A. M. N. H. No. 30126; adult ♂; Kuatun, Chungan Hsien, northwest Fukien Province, China; altitude 5500-6000 feet; April-September, 1926; Clifford H. Pope.

DIAGNOSIS.—Closely allied to *boettgeri* of the same locality and *minor* of Szechwan. It differs from the former in the possession of a dark, thin, X-shaped marking occupying the middle of the back, in being dull brick-red instead of blackish, and in having distinctly smaller toe webs. *M. boettgeri* is a slightly larger species. The tibia of the new species is less than half as long as the head and body, while that of *minor* is more than half this length. The tibio-tarsal articulation, when stretched forward in *kuatunensis*, reaches as far as the center of the eye or not so far, but in *minor* it extends beyond the eye.

DESCRIPTION OF TYPE.—Tongue entire, vomerine teeth lacking. Head moderate, as broad as long; snout very short, obliquely truncate, strongly projecting beyond the mouth. Canthus rostralis angular, loreal region concave; interorbital space as broad as the upper eyelid; tympanum distinct, half the diameter of eye. Fingers slightly swollen at the ends, first and second equal. Toes slender, scarcely swollen at the tips, with barest rudiment of web; a small, oval, flat inner metatarsal tubercle; no subarticular tubercles. The tibio-tarsal articulation reaches to the center of the tympanum, while the tibia is two-fifths as long as the head and body. The skin is smooth. Length, from snout to vent, 32 mm.

The dorsum is brown, a little darker than the ventrum. There is a dark, X-shaped marking on the back and another triangular one on the head, one point of which extends onto either upper lid. In addition to these, there are a few small spots on the back. The belly is boldly spotted with dark spots, the two largest of which are light-centered and occupy a lateral position on the middle region of the belly, the next pair in size being on either side of the throat. A conspicuous spot is found midway between the arm insertions. The lips are barred, especially the lower. The limbs are barred dorsally and, except the ventral side of the thighs, spotted below the bars. A dark band extends from the tibio-tarsal articulation onto the bottom of the foot. There is a white spot on the back of the thigh.

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 87.

NOTES ON PARATYPES.—The thirty-one paratypes come from the type locality (A. M. N. H. Nos. 30123-24 and 30230-58) and agree well with the type. Tadpoles were secured.

This species, though remarkably similar to *boettgeri* in body form, is easily distinguished by the χ -shaped, dorsal marking, no trace of which is ever present in *boettgeri*. The type of *minor* is unique and shows no sign of a dorsal marking. I have omitted this point from the diagnosis because lack of such in *minor* may be the result of preservation.

The texture of the skin in *boettgeri* and *kuatunensis* is extremely variable, though the latter has the smoother skin in the majority of specimens.

These two species inhabit the same streams about Kuantun but *kuatunensis* is invariably found at higher altitudes. There is a marked difference in their calls.

***Hyla sanchiangensis*, new species**

TYPE.—A. M. N. H. No. 30198; adult ♂; San Chiang, Chungan Hsien, north-west Fukien Province, China; 3000-3500 feet altitude; April-May, 1926; Clifford H. Pope.

DIAGNOSIS.—A mountain form closely related to *chinensis* but differing conspicuously in coloration.

DESCRIPTION OF TYPE.—Vomerine teeth two-thirds behind line joining anterior edges of choanae, nearer to each other than to choanae. Diameter of tympanum two-fifths that of eye; diameter of finger pads slightly greater than that of toe pads. Tibiotarsal articulation reaching center of eye. Fingers with small webs; toes two-thirds webbed. Skin smooth. Length, from snout to vent, 34 mm.

The back is purplish brown (leaf-green in life), the belly uniformly light. There are numerous black spots on the posterior sides, both sides of the upper legs, and the inside of the lower legs; also on the arms and around their bases. A fine black line starts at the tip of the snout, passes over the nostril, through the eye, immediately above the tympanum, and along the upper sides to join the first black spots of the posterior sides. A similar line beginning below the nostril skips the eye and skirts the tympanum, extending parallel to the first line as far as the base of the forearm where it meets the black spots of that region. In alcohol the color of the area between these two lines is not markedly different from the general color of the sides. The upper lips are weakly and irregularly bordered with black.

The type, taken during the breeding season, has conspicuous dark nuptial pads on the inner fingers and large grayish vocal sacs just anterior to the insertion of the foreleg.

NOTES ON PARATYPES.—The twenty-nine paratypes (A. M. N. H. Nos. 30171-97 and 30199-200) come from the type locality and agree with the type in every essential. A series of tadpoles was also secured.

The conspicuous black markings of this species distinguish it at a glance from *arborea immaculata* of the Yangtze Valley, *simplex* of the extreme South, and Vogts' *alboteniata* of "South China." *H. annectans*

of Yunnan possesses the strong tuberculated fold from the eye to the base of the upper arm of which no sign is present in the new species, while *bambusicola* (*monticola*) of Szechwan has many red-centered ocelli on the back. *H. chinensis* entirely lacks the black spots on the forearm as well as the fine parallel lines described above, and possesses a sharply differentiated reddish-brown (in alcohol) triangle outlined in black covering the tympanum and ending just above the base of the forearm.

***Rana chunganensis*, new species**

TYPE.—A. M. N. H. No. 30479; adult ♂; Kuatun, northwest Chungan Hsien, Fukien Province, China; 4500–5000 feet altitude; August, 1926; Clifford H. Pope.

DIAGNOSIS.—A *Hylorana* with well-formed digital pads bearing distinct crescentic grooves separating the upper from the lower surfaces. The pads are not twice as broad as the narrowest part of the corresponding penultimate phalanx. There is a weakly developed dorso-lateral fold. Sexual dimorphism is extremely marked, the male being much smaller in size and lighter in dorsal coloration than the female. The male moreover possesses a pair of prominent external vocal sacs, a humeral gland, and a pad on the first finger.

DESCRIPTION OF TYPE.—Vomerine teeth in oblique series, their anterior edges on a line with centers of choanæ.

Head longer than broad, depressed; snout projecting beyond mouth, slightly longer than eye; canthus rostralis obtuse; loreal region feebly oblique, concave; nostril barely nearer tip of snout than eye; distance between nostrils equal to inter-orbital width; tympanum distinct, three-fifths diameter of eye, separated from eye by a distance equal to half diameter of tympanum.

Fingers long and slender, their tips bearing pads with distinct crescentic grooves separating the upper from the lower surface; first finger barely as long as second, a pad on its inner side. Subarticular tubercles well developed. Toes with pads similar in form and size to those of fingers; webbed to base of pads on all but longest toe where webbing reaches only to last subarticular tubercle; latter well developed as on fingers; outer metatarsals separated nearly to base. Inner metatarsal tubercle oval, feebly prominent, no outer tubercle.

Hind limb long and slender, tibio-tarsal articulation reaching to end of snout; heels strongly overlapping; tibia contained 1.7 times in length of head and body.

Dorso-lateral fold feeble, especially posteriorly; a glandular fold from below tympanum to shoulder. Skin smooth.

The color is reddish brown above but light beneath. The back is covered with dark speckles. A black stripe extends from the tip of the snout to the eye and from behind the eye to the base of the thigh. Posterior to the eye its upper border is the dorso-lateral fold. The stripe is widest from the eye to above the insertion of the forelimb, posterior to which it rapidly narrows. The tympanum is included in this stripe. A narrow white stripe extends from below the nostril to the shoulder. It passes just under the eye and tympanum. The limbs are barred dorsally.

There is a large, external vocal sac on each side extending from below the eye to the base of the forelimb and an oval gland on the inner arm.

The type measures 39 mm. from snout to vent.

NOTES ON PARATYPES.—Ninety-two paratypes come from the type locality (Nos. 28832, 30139-41, 30395-478 and 30480-83), three from Yenping (Nos. 28419 and 30820-21). All the males agree well with the type. An adult female measures 58 mm. from snout to vent. A large series of tadpoles was secured.

This species seems to be related to *humeralis*, and *oatesii* of Burma, and *miopus* of Siam, which form a group in Boulenger's *Hylorana* key. It resembles these in the possession of the humeral gland but differs in the comparative length of the first two fingers as well as many minor points.

Rana fukienensis, new species

TYPE.—A. M. N. H. No. 29182; adult ♀; Futsing Hsien, northeastern Fukien Province, China; August-October, 1925; Clifford H. Pope.

DIAGNOSIS.—A species combining the characters of *nigromaculata* and *plancyi*. Its relation to *plancyi* is shown through the white stripe along the back of the thighs so characteristic of that species, and the lack of an external vocal sac in the males, while in general habitus and coloration it strongly suggests *nigromaculata*.

DESCRIPTION OF TYPE.—Vomerine teeth in two rounded groups between the choanae, their distance from the latter about equal to the distance between them; nostrils distinctly nearer the tip of the snout than the eye; toes fully webbed; tips of digits tapering, rounded, not at all expanded or grooved; subarticular tubercles distinct but small; inner metatarsal tubercle medium, its length half that of the fifth toe; an indistinct outer tubercle, no tarsal fold; an inconspicuous dorso-lateral fold. The skin is generally smooth but in the posterior region of the back finely granular.

The color of the back in alcohol is grayish olive with a faint mid-dorsal longitudinal stripe from the tip of the snout to the vent. The ventrum is light with very faint gray mottling more distinct on the thighs. There are a few black spots on the posterior region of the back and irregular bars across the tibia. A distinct white band extends along the back of the thighs above which the thighs are boldly mottled. A black band starts at the base of the thigh and extends forward along the side. It breaks into spots before reaching the insertion of the arm but is continued as a band along the posterior side of the arm to the palm. There is another black line from the shoulder to the angle of the jaw.

The length of the tibia (39 mm.) is 0.54 that of the distance from the snout to the vent (72 mm.)

NOTES ON PARATYPES.—There are fifteen paratypes from the type locality (A. M. N. H. Nos. 29183-89 and 29420-27), and four from Chungan Hsien (A. M. N. H. Nos. 28946-49), all collected in 1925. In addition, a juvenile paratype (A. M. N. H. No. 30001) was collected the following year in Chungan Hsien. The paratypes with one exception agree in every essential with the type. The American Museum contains a large series from Horisha, Formosa, previously identified as *plancyi*. They agree well with the new species except that their bellies are lighter and less mottled.

R. fukienensis seems to be intermediate between *plancyi* and *nigromaculata*. It may readily be told from *plancyi* by:

(1) Its much shorter and lower metatarsal tubercle. This tubercle is only one-half the length of the fifth toe, but in *plancyi* it is three-fourths this length. In *plancyi*

it is set at a distinct angle to the line of the first toe, while in *fukienensis* it is almost parallel. This difference is very constant.

(2) Its distinctly greater leg length. The length of the tibia in *plancyi* is contained two and one-third to two and a half times in the length from the snout to the vent, the tibio-tarsal articulation barely reaching the tympanum, while in *fukienensis* the tibia is one-half as long as the body and head, and the tibio-tarsal articulation reaches the center of the eye.

(3) The dorso-lateral ridges. In *plancyi* these are uniformly broad, low and often flaring; in *fukienensis* either narrow or broad, high or low, and nearly or perfectly parallel.

(4) Coloration. *R. plancyi* lacks the mid-dorsal stripe, which though often faint, is nearly always present in *fukienensis*. The thighs, above the light stripe possessed by both species, are much more boldly mottled in *fukienensis*, while *plancyi* has an immaculate belly contrasted with the more or less faintly mottled belly of mainland *fukienensis*.

It may be readily told from *nigromaculata* by:

(1) The smaller metatarsal tubercle which in *nigromaculata* rivals that of *plancyi* in size.

(2) The lack of glandular ridges between the dorso-lateral folds. These ridges are very conspicuous in *nigromaculata*. The juvenile specimen (No. 30001) forms the only exception among the large series of paratypes.

(3) The apparent lack of a well-developed external vocal sac. All of the larger paratypes are females and the general scarcity of males makes the confirmation of this point desirable.

(4) Coloration. The light stripe along the thighs so characteristic of *plancyi* and *fukienensis* is never found in *nigromaculata* which also seldom shows traces of the black lateral stripe very conspicuous in *fukienensis* and present at least posteriorly in *plancyi*.

In addition, there are minor differences of color, and certainly a comparative examination of living specimens would reveal still more striking contrasts.

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EMBOLOTHERIUM, GEN. NOV., OF THE ULAN GOCHU, MONGOLIA^{1 2}

BY HENRY FAIRFIELD OSBORN

The Oligocene titanotheres discovered in the seasons of 1922 and 1923 were first described and figured in previous numbers of *Novitates* and are fully monographed in the appendix of the U. S. Geological Survey Monograph No. 55, "The Titanotheres of Ancient Wyoming, Dakota, and Nebraska," pp. 895-945 (now in press). They embrace genera and species discovered in three formations and life zones, as below. At the time it was thought that the Ardyn Obo formation (500 ft. in thickness, containing *Brontops gobiensis* and *Menodus mongoliensis* of supposed Lower Oligocene age) represented the close of the Titanotherium dynasty in Mongolia. Accordingly the succession of horizons given below (p. 2) was published in 1925-1927.

DISCOVERY OF TWO NEW FORMATIONS AND LIFE ZONES

The seasons of 1924 and 1925, however, closed with the discovery of two new and highly fossiliferous Oligocene formations on the Ulias-sutai-Sair Usu-Kalgan trail lying conformably above the Shara Murun formation; these formations were first described in field notes as *Upper Shara Murun*. The workings (Fig. 1, Sect. 4) at Ula Usu (1923-1925) yielded *Menodus mongoliensis* and *Brontops gobiensis* as of typical Oligocene age (Ardyn Obo formation); in August and September of the same year Granger notes at Ula Usu, in the formations "Shara Murun and Upper Shara Murun" titanotheres numbers 566 (hind foot), 569 (fore foot), 570 (fore foot), and 571 (front of skull), from "red beds" underlying the fossiliferous "gray beds" bearing titanotheres, also a titanotherium skeleton of *Dolichorhinus* type.

Titanotherium skeleton. Uncovered but not taken. *Dolichorhinus* type. The posterior portion of skull and jaws; the entire column back to the 8th caudal; the scapulæ, humeri, one femur and the pelvis, with all ribs of one side and several of the other side in the bank. Other parts evidently had been present but eroded

¹Preliminary popular description in *Natural History*, Vol. XXIX, No. 1, 1929, pp. 2-16.

²Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 88.

THREE SUCCESSIVE TITANOTHERE BEARING FORMATIONS OF MONGOLIA

| Formation | Estimated Thickness | Geographic Region | Life Zone | Probable or Estimated Age |
|-------------|---------------------|-------------------|---|--|
| Ardyn Obo | <i>Feet</i> 500 | Uliassutai trail | Brontops gobiensis zone; Menodus mongoliensis | Lower Oligocene |
| Shara Murun | 500 | Uliassutai trail | Protitanotherium mongoliense zone; Dolichorhinus, Telmathierium, Mantecoceras | Summit of Eocene. Titanotheres very abundant |
| Irden Manha | 40-100 | Iren Dabasu basin | Protitanotherium graingeri zone; Dolichorhinus cf. seni, Telmathierium berkeyi. | Upper Eocene. Titanotheres present |

away. Bone very soft; vertebral centra rather badly flattened. No teeth. Found by Dr. Loucks in red clays west of camp at Ula Usu—1 mile. August 15th. 5×7 photograph taken. Vertebral formula: 7:17:4:3:8+.

[Field No.] 573 Miscell. Mammals. From various points along the northeastern face of the Ula Usu peneplane—mostly from two pockets, four and eight miles north of Baron Sog Lamasery. August 16—Party. As far as possible only such bones as come from the lower gray beds (true Shara Murun) are recorded under this number.

[Field No.] 574 Artiodactyl. Upper teeth and foot bones. Aug. 18—Olsen. From Upper Red beds [=Ulan Gochu formation].

[Field No.] 575 Miscell. Mammals etc. From an upper horizon exposed along the eastern face of the peneplane from the Baron Sog Lamasery northward for 4 miles [Baron Sog beds]. Probably Oligocene (light gray beds). August—Party.

From the above citations, to be compared with figures 1 and 2 and Granger's "Record of Fossils, Mongolia, 1925," pp. 43–86, it appears that Granger in 1925 discovered and clearly demarcated *two new and rich faunal horizons* without naming them, i.e., the *Baron Sog* and the *Ulan Gochu*. He also recognized as a new form of titanotheres the anterior portion of a cranium (Field No. 595, Amer. Mus. 21610—Figs. 9, 10), discovered in the base of the "upper red beds," four miles north of Baron Sog, to which in the present *Novitates* is assigned the name *Embolotherium loucksii*, in honor of Dr. Harold Loucks, the discoverer of this unique specimen. This bears the inscription (Granger's "Record of Fossils, Mongolia, 1925," p. 56):

[Field No.] 595 Horned Perissodactyl. Portion of skull with horn and last molar tooth of right side. From base of Upper Red Beds [=Ulan Gochu] 4 miles north of Baron Sog Lamasery. Sept. 2—Granger. Found by Loucks. [= *Embolotherium loucksii*.]

These two new faunal horizons are:

Baron Sog Formation (Granger, 1925, 1928). Estimated thickness 35 feet, containing numerous new and undescribed baluchitheres—Field Nos. 731, 732, 744, 745, 753, 773, and 780, also undescribed entelodonts, lophiodonts, rhinocerotids, chalicotheres, etc. No record of titanotheres or embolotheres.

Ulan Gochu Formation (Granger, 1925, 1928). Estimated thickness min. 132 feet, max. 195 feet; containing embolotheres—Field Nos. 595 (type of *Embolotherium loucksii*), 750 (type of *Embolotherium andrewsi*), 735 (*Embolotherium andrewsi* ref.), 708 (*Embolotherium andrewsi* ref.), 770 (type of *Embolotherium grangeri*), 756 (*Embolotherium grangeri* ref.), and 673 (*Embolotherium grangeri* ref.); also numerous undescribed embolotheres—Field Nos. 740, 741, 742, 746, 751, 755, and 782, as well as undescribed lophiodonts, rhinocerotids, artiodactyls, and carnivores. No baluchitheres thus far certainly recorded.

A sharp unconformity (Fig. 2, Sects. 1, 2, 3) between the Ulan Gochu (oblique shading) and the overlying Baron Sog indicates that a long interval in geologic time elapsed between these two formations.

During this interval may possibly have occurred to the east (Houldjin) and to the northwest (Hsanda Gol) the deposition (3,000 ft.) of the Hsanda Gol and (30 ft.) of the Houldjin (*Baluchitherium grangeri* zone), because both Andrews and Granger believe that the undescribed *Baluchitherium* sp. of the Baron Sog formation belongs to a specific and perhaps generic stage more advanced than *Baluchitherium grangeri*.

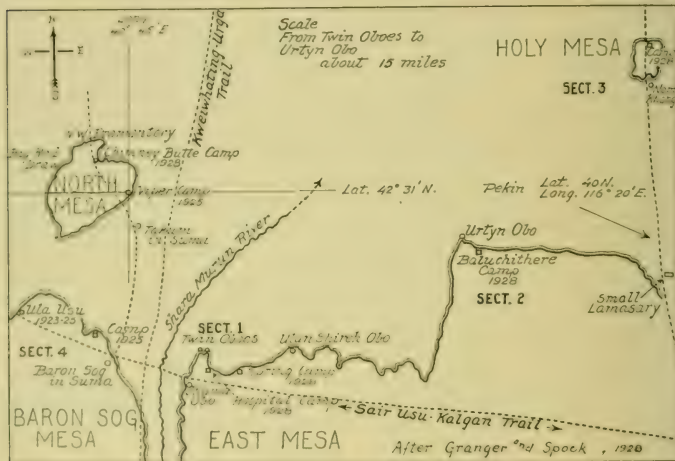
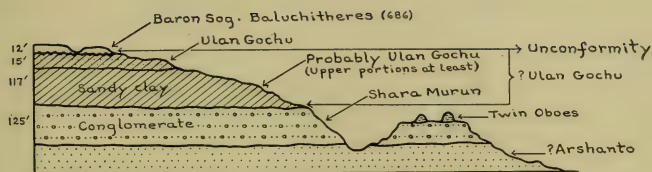


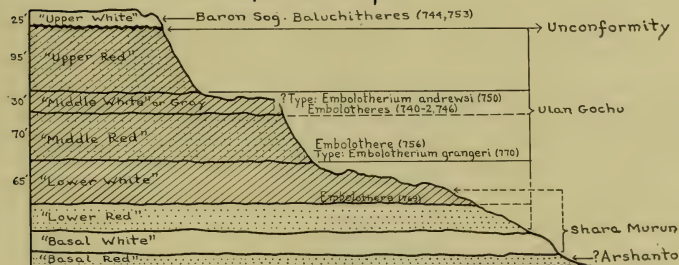
Fig. 1. Sketch map by Granger and Spock (1928) along the Sair Usu-Kalgan trail, 15 miles east and west, displaying exposures of typical Shara Murun, and 'upper Shara Murun' or the new 'Ulan Gochu' and 'Baron Sog' formations explored by the American Museum parties of the years 1924-1925 and 1928. After sketch by Walter Granger.

From the summit of the Ulan Gochu downward there are no apparent breaks. Granger writes (letter, Peking, December 31, 1928):

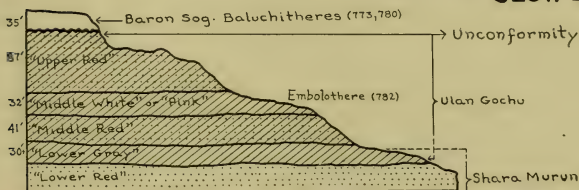
You will notice from these sections [Fig. 2] that we have no sharp line between the Ulan Gochu beds and the Shara Murun. The geologists have not been able to discover any stratigraphic break between the top and the base of these Eocene sediments of the Shara Murun region and we have set off the 'Ulan Gochu beds' from the 'Shara Murun' on the basis of faunal change only. I have used the name, 'Ulan Gochu,' to cover such strata as contain the new type of titanotheres [*Embolotherium lauchensis*], and certain advanced artiodactyls which do not occur in the typical Shara Murun of Ula Usu. The whole fauna of these Ulan Gochu beds will probably show a



Section through East Mesa at Twin Oboes.
Hospital Camp. **SECT. 1**



Section at Urtyn Obo. Baluchithere Camp.
SECT. 2



Section at Nom Khong Shireh. **SECT. 3**
Holy Mesa Camp. After Granger and Spock

Fig. 2. Sections through the Shara Murun, Ulan Gochu, and Baron Sog formations at the points indicated in figure 1. After sketch by Walter Granger. Theoretic limits of the 'Ulan Gochu' formation, *Embolotherium* zone, in oblique shading.

Sect. 1. Through East Mesa at Twin Oboes, Hospital Camp (1928).

Sect. 2. At Urtyn Obo, Baluchithere Camp (1928), type locality of *Embolotherium andrewsi* and of *E. grangeri*.

Sect. 3. At Nom Khong Shireh, Holy Mesa Camp (1928).

There is a sharp *unconformity* and erosional interval between the *Ulan Gochu* and overlying *Baron Sog*. The *Ulan Gochu* passes insensibly below into the *Shara Murun*.

distinct advance over that of the Shara Murun beds but I have just used these two as guide fossils. One titanotheres skull from the Ulan Gochu beds (No. 742) is not of the *Embolotherium* type but is much like your *Brontops gobiensis* from the Ardyn Obo beds and I have been wondering if we do not have in the Shara Murun region sediments a transition, without break, from the Eocene to the Oligocene.

The discovery of these two new formations reveals a survival of the titanotheres in Mongolia, after their extinction in America, and renders probable a new theoretic sequence of life zones as below (p. 7).

THE ULAN GOCHU OR EMBOLOTHERIUM LIFE ZONE

The present *Novitates* is based upon eight specimens only, referable to three very distinct species of *Embolotherium*. Other specimens when received may reveal relationships to *Brontops gobiensis* or to other Lower Oligocene titanotheres such as *Menodus*. The characterizations are in a high degree preliminary.

As shown in Fig. 2, Sect. 2, at Urtyn Obo, the levels are divided as follows:

95' "Upper Red." *Embolotherium* No. 673. (Base of: *Embolotherium loucksii* type.)

30' "Middle White" or "Gray," or "Pink." *Embolotherium andrewsi* type (No. 750). *E. andrewsi* ref. (No. 708), also *Embolotherium* (Nos. 740-742, 746).

70' "Middle Red." *Embolotherium grangeri* type (No. 770), also *Embolotherium* (No. 756).

65' "Lower White." *Embolotherium* (No. 683).

The levels of all the *Embolotherium* and other titanotheres remains have been carefully recorded and the vertical succession and evolution of the species will doubtless become evident and clear when the entire collection can be examined. Some of the specimens labeled "Titanotheres" may prove to belong to other genera than *Embolotherium*.

All the remaining embolothere specimens, besides the eight herein described, have been prepared in the laboratory at Peking and are now on their way to the American Museum. We had hoped to receive these fossils in order to make the preliminary description more complete, but the long delay has compelled the writer to base his present description and figures on the materials in hand and on photographs and data relating to the specimens in Peking, kindly forwarded by Mr. Granger.

Fig. 3. Comparison of type crania.

Fig. 4. *Embolotherium andrewsi* type (Amer. Mus. 26001). After original.

Fig. 5. *Embolotherium andrewsi* ref. After photograph.

Fig. 6. *Embolotherium andrewsi* ref. Skull presented to the Chinese Geological Survey Museum.

NEW THEORETIC SEQUENCE (1929) OF MIDDLE OLIGOCENE TO UPPER EOCENE FORMATIONS

| Formation | Estimated Thickness <i>Feet</i> | Geographic Region | Life Zone | Probable or Estimated Age |
|-------------------------------------|------------------------------------|--|---|--|
| Baron Sog Hsanda Gol Houldjin | 35 3,000 30 | Uliassutai trail Eastern Altai Iren Dabasu basin | Baluchitherium n. sp. Baluchitherium grangeri zone Baluchitherium grangeri? zone | Lower and Middle Oligocene Lower and Middle Oligocene Lower and Middle Oligocene |
| Ulan Gochu Ardyn Obo | { Min. 132 Max. 195 500 | Uliassutai trail Uliassutai trail | Embolotherium andrewsi zone; E. loueksi, E. grangeri Brontops gobiensis zone; Menodus mongoliensis | Extinction of titanotheres Lower Oligocene |
| Shara Murun | 500 | Uliassutai trail | Protitanotherium mongoliense zone; Dolichorhinus, Telmathierium, Mantecoceras | Summit of Eocene. Titanotheres very abundant |
| Irdin Manha | 40-100 | Iren Dabasu basin | Protitanotherium grangeri zone; Dolichorhinus olseni, Telmathierium berkeyi | Upper Eocene. Titanotheres present |



Fig. 3. Comparison of type crania of:
 C, *Embolotherium andrewesi* type (Amer. Mus. 26001, Field No. 750).
 B, *Embolotherium grangeri* type (Amer. Mus. 26002, Field No. 770).
 A, *Embolotherium loucksii* type (Amer. Mus. 21610, Field No. 595).
 One-tenth natural size.

Fig. 7. *Embolotherium grangeri* type (Amer. Mus. 26002). After photograph of cranium from Peking laboratory. *Embolotherium grangeri* ref. After photograph from Peking laboratory.

Fig. 8. *Embolotherium grangeri* ref. After photograph from Peking laboratory.

Fig. 9. *Embolotherium loucksii* type (Amer. Mus. 21610). After original.

Fig. 10. Photographic view of same.

EMBOLOTHERIINÆ, subfam. nov.

One of the most surprising results of the Fifth Central Asiatic Expedition of the season of 1928, under the leadership of Roy Chapman Andrews and Walter Granger, was the discovery of an entirely new type of titanotheres.

The subfamily Embolotheriinae, typified by the characters observed in three distinct species of *Embolotherium*, probably represents a purely Asiatic phylum, no members of which have thus far been discovered in North America; nor do the three species of *Embolotherium* herewith described from the Ulan Gochu formation seem to be related to the titanotheres discovered in the three older geologic formations previously described; they appear rather to represent immigrants into the central Gobi region, whose ancestors lived farther north in central Asia.

In all, at least fourteen individual specimens of *Embolotherium* were found in the Ulan Gochu formation associated with the remains of lagomorphs and other rodents, carnivores, creodonts, hyænodonts, rhinocerotids, lophiodonts, and entelodonts characteristic of Lower to Middle Oligocene age. As shown in three sections (north of the bluffs on the Sair Usu-Kalgan trail, lat. 42° 31' N.) prepared by Granger and Spock (Fig. 2), the Ulan Gochu formation has a thickness of 132 feet at Twin Oboes, 195 feet at Urtyn Obo, and 190 feet at Holy Mesa, thus representing a long period of geologic time.

EMBOLOTHERIUM, gen. nov.

Genotypic species *Embolotherium andrewsi*, sp. nov.

GENERIC CHARACTERS.—Premaxillaries elongate (*Embolotherium grangeri*), reduced (*E. andrewsi*); elevated anterior bony protuberances or nasal horns expanded at the summits, moderately broad (*E. loucksii*), extremely broad (*E. andrewsi*); frontals normal not entering into nasal protuberances. Broad postorbital expansion of vertex; zygomata extremely broad. Premolars with prominent tetartocones and partly separate metalophs; M 3 with prominent hypocone (*E. andrewsi*).

The generic name *Embolotherium* is given in reference to the unique structure of the forward portion of the cranium. The name is derived from the Greek ἐμβολή, "battering ram." As the 'brontothere' used



Fig. 4



Fig. 5. *Embolotherium andrewsi* Osborn, ref. Field No. 735, 1928 Coll., Amer. Mus. 26003. Ulan Gochu formation, Urtyn Obo section, level unrecorded. Adult cranium of very large size, length from tips of complete premaxillaries to occipital crest, 940 mm. or 3 ft. 1 in. Prepared in the Peking laboratory and repasted for shipment. One-tenth natural size.

Fig. 4. *Embolotherium andrewsi* Osborn, type. Field No. 750, 1928 Coll., Amer. Mus. 26001. Ulan Gochu formation, Urtyn Obo section, "middle white" or "gray" beds, 125 ft. below Baron Sog unconformity. Cranium with maxillary rostrum wanting, dentition damaged, lateral, oblique, posterior, and anterior aspects. One-tenth natural size. Compare figure 6.

PRINCIPAL MEASUREMENTS

| | |
|--|----------|
| Length: | |
| Summit of nasals to summit of occipital crest..... | 1028 mm. |
| Base of nasals to back of occipital crest..... | 852 |
| Auditory opening to front border of orbit..... | 518-532 |
| Height: | |
| Occipital condyles to occipital crest..... | 370 |
| Lacrymal foramen to summit of nasals..... | 594 |
| Width: | |
| Maximum width of nasals..... | 342 |
| Minimum width of nasals..... | 180 |
| Transverse of zygomatic arches..... | 318 |
| Transverse of occipital crest..... | 440 |
| Transverse of occipital condyles..... | 194 |



Fig. 6

its horns in tossing, the 'embolothere' used its horns for battering, assaulting, attacking, and tossing. Hence the name "battering-ram-nosed titanothere" seems appropriate. From the front part of the face there arises a single bony horn, of completely novel form, composed of elongated and uplifted nasal bones; these bones are supported on a firm base of the frontals and maxillaries. In the genotypic species, *Embolotherium andrewsi*, the nasal horn rises to a height of 28 inches (Fig. 4) and expands very broadly at the summit into a rugose bony prominence, on the under surface of which is an upward extension of the anterior nares. This single nasal protuberance is totally different in structure from the paired frontonasal bony horn of all previously known titanotheres as shown by comparison with the frontonasal horn in the juvenile skull of *Brontops brachycephalus* or with that in the adult skull of *Brontotherium platyceras*. This profound structural difference was not realized until the juvenile skull of *E. andrewsi* revealed this wide contrast between *Embolotherium* and *Brontotherium*.

***Embolotherium andrewsi*, sp. nov.**

TYPE.—Amer. Mus. 26001, figure 4. Cranium with maxillary rostrum wanting, dentition damaged.

LOCALITY.—East Mesa, "middle white" or "gray" beds, Mongolia.

HORIZON.—Ulan Gochu.

SPECIFIC CHARACTERS.—Premaxillo-maxillary rostrum reduced, abbreviate, bony horn rising above and anterior to the orbits, extremely broadened at the summits, infolding nasal chamber inferiorly. Known from three complete crania and other specimens found in the levels of the Ulan Gochu formation.

Fig. 6. *Embolotherium andrewsi* Osborn, ref. Field No. 708, 1928 Coll., Amer. Mus. 26000. Ulan Gochu formation, channel deposit, Ulan Shireh Obo section, top of "gray" beds or of "middle white" beds. Fully adult skull with complete nasals and fractured rostrum, and finely preserved grinding teeth. Presented to the Chinese Geological Survey Museum, December, 1928. Superior, anterior, lateral, and palatal aspects. One-tenth natural size.

PRINCIPAL MEASUREMENTS

Length:

| | |
|---|---------|
| Premaxillæ to condyles..... | 780 mm. |
| Occipital crest to center of nasal tip..... | 770 |
| Lacrymal process of orbit to tip of nasals..... | 370 |
| Premolar-molar series, P 1-M 3..... | 310 |

Width:

| | |
|---|-----|
| Transverse of nasal extremities..... | 260 |
| Transverse across zygomatic arches..... | 500 |
| Vertex across postorbital process..... | 310 |

This superb animal, as fully represented in figures 4, 5, and 6, constitutes one of the greatest surprises in the long palæontologic history of the titanotheres, because it differs from all previously known forms in the single rather than the paired structure of the bony horn and in its composition, which is clearly shown in the young individual (Amer. Mus. 26040, *E. grangeri*), see figure 8. Whereas in all other titanotheres the bony horn arises from the frontals, overlapping the nasals which are gradually reduced in size, in the present animals no frontal horn is known to have developed, but the nasals (*Na*) composed the entire anterior prominence, carrying forward on the lower surface (Figs. 3, 4 and 8) the prolongation of the anterior nares. In brief, in all previously known titanotheres the frontals form the chief element in the horn and the nasals are reduced; in these embolotheres a complete change of function takes place, i.e., the nasals form the anterior bony horn. There was much speculation about this by the author and by Dr. W. K. Gregory and others until a photograph of the juvenile skull of *Embolotherium grangeri* reached the Museum, which appeared to settle the question.

Such bony composition of the nasal horn is apparently characteristic of all three species, which, however, differ widely in the shape of the horn and in the abbreviation (*E. andrewsi*) or elongation (*E. grangeri*) of the premaxillary rostrum.

In *Embolotherium andrewsi* we apparently have the most extreme stage of embolothere development, in which the single horn is the longest, widest, and most prominent and the premaxillaries are the smallest and most reduced, as shown in the referred specimen of *E. andrewsi* (Amer. Mus. 26003) represented in figure 5, after photograph in the pasted condition in the Peking laboratory.

***Embolotherium grangeri*, sp. nov.**

TYPE.—AMER. MUS. 26002, figure 7 (upper). Cranium with elongated rostrum.

LOCALITY.—East Mesa, "middle red" beds, Mongolia.

HORIZON.—Ulan Gochu.

SPECIFIC CHARACTERS.—Maxillo-premaxillary rostrum elongate, nasal bony horn extending upward and forward, slightly recurved on lower surface, with convex superior border, arising from mid-cranium somewhat posterior to orbit. Zygomatic arches very broad; summit of nasal protuberance moderately broad. Known from the type and other individuals found in the upper levels of the Ulan Gochu formation.

The present species is readily distinguished from *Embolotherium andrewsi* by three characters: (1) The elongation of the maxillo-premaxillary rostrum; (2) the elevation of the horn from the middle region of the cranium somewhat posterior to the orbits, whereas in *E.*

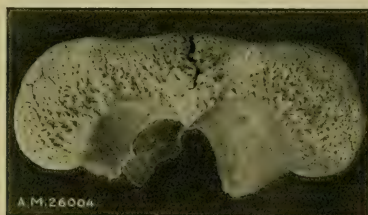


Fig. 7. (Upper) *Embolotherium grangeri* Osborn, type. Field No. 770, 1928 Coll., Amer. Mus. 26002. Ulan Gochu formation, Urtyn Obo section, base of "middle red beds," 195 ft. below Baron Sog, 65 ft. above Shara Murun. Type cranium with elongated rostrum, as prepared in the Peking laboratory and repasted for shipment. One-tenth natural size.

Fig. 7. (Lower) *Embolotherium grangeri* Osborn, ref. Field No. 756, 1928 Coll., Amer. Mus. 26004. Ulan Gochu formation, Urtyn Obo section, "middle red beds." A complete skull base with top weathered off; tip of nasals with median suture and heavy septum ridge; heavy rugose extremity, partly cartilaginous in this young individual (M³ slightly worn). One-fifth natural size. Discovered on the level of *E. grangeri* type.

andrewsi the horn rises directly above the orbits as in other progressive genera of the titanotheres; and (3) the bony horn of *E. grangeri* presents a downward and forward curvature, being concave on the lower surface and convex on the upper or posterior surface, whereas in *E. andrewsi* the horn is convex anteriorly and concave posteriorly, as in the genus *Brontotherium*. As shown in side view the type of *E. grangeri* is a considerably smaller animal than *E. andrewsi*.

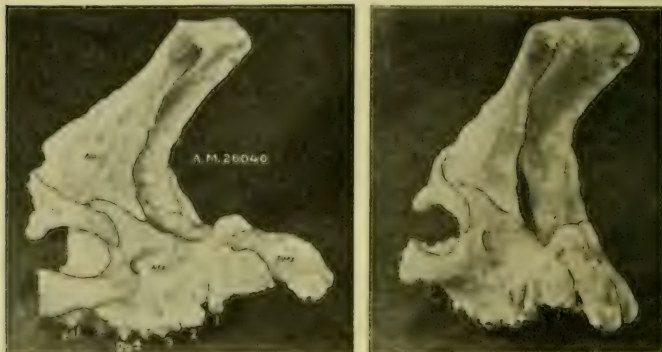


Fig. 8. *Embolotherium grangeri* Osborn, ref. Field No. 673, May 7, 1928 Coll., Amer. Mus. 26040. Ulan Gochu formation, Twin Oboes section. Juvenile cranium exhibiting sutures of *Na.*, *Fr.*, *Mx.*, *Pmx.*, in oblique frontal and lateral aspects. Lower edge of left nasal has been crushed downward and inward. About one-tenth natural size.

***Embolotherium loucksii*, sp. nov.**

TYPE.—Amer. Mus. 21610, figures 9 and 10. Anterior portion of adult cranium, female (?).

LOCALITY.—Base of "upper red beds," 4 miles north of Baron Sog Lamasery, Mongolia.

HORIZON.—Ulan Gochu.

SPECIFIC CHARACTERS.—Premaxilla elongate, nasal protuberance with upward and forward curvature arising from middle portion of vertex and directly above orbits. straight superior border, relatively narrow at summit. Known from type specimen only.

This specimen is the first one discovered and was at once recognized as a very peculiar animal, in fact, it proved to be difficult to compare it with other titanotheres because it was obvious that the composition of the bony horn was entirely different. As admirably represented in figures

9 and 10, the nasal horn prominence rises directly above the orbits and extends directly forward and upward, unlike the recurved horn of *Embolotherium andrewsi* or the decurved horn of *E. grangeri*. On the inferior surface, as shown in figure 9, the lateral portions of the nasals are brought together and the very broad narial channel observed in *E. andrewsi* (Fig. 4) is wanting; the anterior nasal opening is correspondingly reduced; the nasal bony horn terminates in a rounded club-shaped expansion, quite different from the broad plate characteristic of *E.*

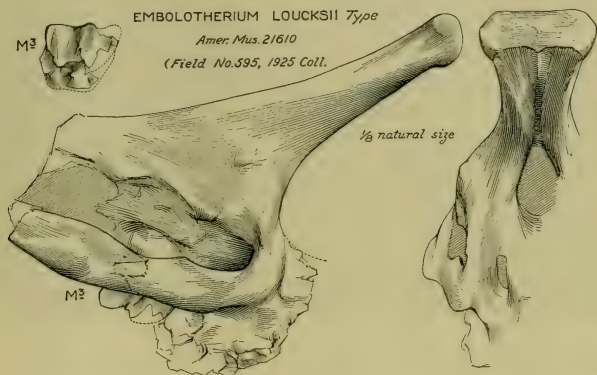


Fig. 9. *Embolotherium loucksii* Ostorn, type. Field No. 595, 1925 Coll., Amer. Mus. 21610. Ulan Gochu formation, base of "upper red beds," four miles north of Baron Sog. Anterior portion of adult cranium, female (?). One-eighth natural size. See Fig. 10.

andrewsi. As further shown in the photograph of the type (Amer. Mus. 21610—Fig. 10) the nasal horn rises directly above and anterior to the orbits, instead of behind the orbits as in *E. grangeri*. It would appear that the premaxillary rostrum is elongated, but this point is difficult to determine in the specimen now in hand.

A striking fact is that the type of *Embolotherium loucksii* (Field No. 595, 1925 Coll., Amer. Mus. 21610) is reported by Granger as from the base of the "upper red beds," four miles north of Baron Sog. From this it would appear that the geologic level is about the same as that of *E. andrewsi*, although it may be hazardous to correlate these two levels at present.



Fig. 10. *Embolotherium loucksii* Osborn, type. Field No. 595 (Amer. Mus. 21610). One-sixth natural size. See Fig. 9.

PRELIMINARY CONCLUSIONS

From the fundamental differences in cranial structure of the three species of *Embolotherium* above described, it seems without doubt that we have to do with three different subphyla of the genus *Embolotherium*, because it is certain that *E. loucksii* cannot be ancestral to *E. grangeri*, nor can either of these species be ancestral to *E. andreusii*. Pending corroboration of this conclusion by the study of more complete materials, it appears that the Embolotheriinae embrace at least three different phyla, which, when we come to examine their dental structure, may prove to be of different generic rank. This preliminary notice may close with a citation from the first announcement of the discovery of this extraordinary new branch of the titanotheriæ family (see footnote, p. 1):

FIRST: Titanotheres, of Lower Oligocene age. Whereas in the Rocky Mountain region titanotheres reached their climax in the giant pair-horned *Brontotherium platycerus* of the Lower Oligocene, they survived and attained a superclimax in the

still larger and more unique battering-ram-nosed *Embolotherium* (Greek ἐμβολή, signifying 'a battering ram') of the Oligocene of the Desert of Gobi. This animal somewhat exceeds in size the largest *Brontotherium* ('flat-horned thunder beast') of North America and develops in the front part of its face an entirely novel nasal battering ram composed of combined nasal and frontal bones. As the 'bronto-



Fig. 11. Preliminary restoration of *Embolotherium andrewsi* based upon the structure of the cranium only. The other portions of the neck and body are restored with the characters of *Brontotherium platyceras*. About one twentieth natural size.

therium' used its horns in tossing, the 'embolothere' used its horns for battering, assaulting, attacking, charging, and tossing. This bony horn rose 28 inches in the very front part of the face and was broadly expanded at the summit. . . . Roy Chapman Andrews informs us (August 22, 1928) that the ram-nosed titanotheres

are from the Ulan Gochu region, probably Middle Oligocene, and belong to the same group as the front portion of the skull found in the Shara Murun by Harold Loucks in 1925, although the new skulls are much larger than the Loucks specimen and are comparable to the largest of our American Oligocene titanotheres. There are no true horns but the frontal and nasal bones are produced upwards and terminate in a transversely broad blunt and rugose end. Fully as impressive as our finest American skulls, they surely represent a distinct phylum of titanotheres.

From the absence of any trace of embolotheres in previously described formations (Ardyn Obo, Shara Murun, and Irdin Manha) it would appear that they were from the first a separate branch of the superfamily Titanotherioidea, which developed in the plains region to the north of the Gobi Desert and finally migrated toward the end of Lower Oligocene time as far south as the southern Gobi where we meet their remains in great abundance and where they attained surpassing size and diversity. It also appears at present, but awaits corroboration, that they succeeded or replaced the genera and species of titanotheres common to the Asiatic and American plains, namely, *Brontops* and *Menodus*.

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MUSTELIDS FROM THE ASIATIC EXPEDITIONS¹

By GLOVER M. ALLEN

On bringing together the mustelids, collected by the Asiatic Expeditions, they are found to comprise over one hundred and forty skins, representing various localities in China (chiefly in Yunnan, Szechwan, and Fukien Provinces) and a few in Mongolia. A critical study of these has entailed a careful consideration of a number of names based on eastern Asiatic specimens, with the result that in many cases it has been possible to arrive at fairly satisfactory conclusions as to their validity. A few wide-ranging species have closely allied representatives in northern India and in parts of China, as *Mustela sibirica*, *M. kathiah*, and *Arc-tonyx collaris*, so that it will be necessary eventually to show the relationship of sundry Chinese forms to Himalayan species by the use of trinomials. A list of the species secured, with brief remarks, follows. Only one new form is described, a northern race of the lesser ferret-badger, a species hitherto known only from Indo-China.

Charronia flavigula flavigula (Boddaert)

Mustela flavigula BODDAERT, 1785, 'Elench. Anim.,' p. 88.

Size of a house cat, with long tail and short legs; head from muzzle to base of ears, the nape, forearms, fore feet, hind legs and tail brownish black; body above golden on shoulders, passing into brown and black on rump; chin to ears white, throat yellow, belly brownish gray; in summer darker above and below on body.

The series of this long-tailed marten includes four from the Namting River, Yunnan, near the Burma border, and one from Lichiang in the same province, that undoubtedly represent the typical form, whose range extends southeastward at least to Siam, for Thomas has lately relegated the name *indochinensis*, based on the Siamese animal, to the synonymy of *flavigula*. There is more or less individual variation in color among these specimens and the matter is further complicated by the fact that summer skins are darker than winter specimens, apparently

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 89.

with an increase in the golden area of the back and a darkening of the belly. It was a dark-bellied skin (May 6), no doubt wholly or partly in summer fur, that served Bonhote as the type of his *Mustela f. kuatunensis* from Fukien, but this supposed race also proves to be untenable, for winter skins from this province are quite as pale-bellied as those from Yunnan taken in February. Indeed, the yellow of the throat seems a very little paler in winter skins from Fukien as compared with the latter, but this difference is so very slight and uncorrelated with other characters, that it seems better to regard the South China form as typical *flavigula*.

A single skin from the Tsingling Range, Shensi, is a trifle paler yellow on the throat and lighter brownish gray above than any of the more southern winter skins but this variation may be individual, or possibly approaches the winter condition of *C. f. borealis* (Radde) of Amur Land, a race that seems to be slightly paler and with a very little larger skull. To this subspecies Jacobi referred the skins from Min Valley region, Szechwan, brought back by the Weigold Expedition and showed that Hiltzheimer's *Mustela f. szetschuensis* is not distinguishable. Additional material from northwestern Szechwan, however, shows no important differences from the Yunnan series and is probably best regarded as *C. f. flavigula*. The range of *C. f. borealis* is probably cut off from that of the Chinese animal by the intervention of the Gobi Desert, except in north-eastern China and Manchuria.

***Mustela larvata tiarata* Hollister**

Mustela tiarata HOLLISTER, 1913, Proc. Biol. Soc. Washington, XXVI, p. 20.

A large weasel, face and forehead dark brown, neck, back, and basal two-thirds of tail light fulvous, with short white underfur, the back darkened by long black-tipped hairs; throat, chest, fore and hind legs, and tip of tail blackish to blackish brown; sides of belly buff.

The weasel described by Hollister from Kansu (150 miles east of Lanchow) as *Mustela tiarata* is undoubtedly a very close relative of *M. larvata* of southern Tibet, from which it differs mainly in having the blackish facial mask continuous with the dark brown of the forehead instead of being separated by a distinct white area, and in having the terminal part only of the tail black instead of its entire length. Apparently Hollister's *M. lineiventer* from the Little Altai is a paler race with the facial mask distinct, while the animal described by Kastschenko from northwestern Mongolia as *nichnoi*, is, as Hollister suggests, probably a race of *evermanni* rather than of *larvata*, so far as may be judged from the

description. The latter is at once separated from *eversmanni* by its larger size, its tail longer in proportion, with a shorter black tip, and by its more yellowish ground color. In Hollister's description of *M. tiarata* the length of the foot is given as 93 mm., evidently a misprint for 63; also the tail of the type is said to have its terminal two-thirds black.

The Asiatic Expeditions secured three skins, from a locality eighty miles southeast of Urga, that conform closely with the description of *tiarata* except that the black tail-tip varies in length in each, from nearly one-half to a third, and even a quarter of the length of the tail. A fourth skin, from Paotou, Shansi, taken in spring is apparently paler on the body and with the forehead and crown as well as the sides of the face white instead of brown, and the nape nearly clear white with a yellow wash, indicating a seasonal difference in the coloring of the head and body. This weasel, like our black-footed ferret, frequents the colonies of marmots and ground squirrels on which it preys.

***Mustela sibirica fontanieri* (A. Milne-Edwards)**

Putorius fontanieri A. MILNE-EDWARDS, 1868-74, 'Recherches Hist. Nat. des Mamm.,' p. 205, Pl. LXI, fig. 1.

Weasel-like, with a long rather bushy tail, three-fifths the length of head and body; color uniform pale fulvous, slightly paler below; forehead brown, chin white, with often white marks on throat.

A careful comparison of Milne-Edwards's description and figure of *Putorius fontanieri*, based on a skin without skull from Peking, leaves no doubt that this animal is a representative of the yellow mink of Siberia and China. The description applies well to a female in pale winter pelage, and the dimensions taken from a skin are nearly identical with those of a female from Shansi. The yellow mink of eastern China has been currently referred to *M. sibirica* of Pallas, whose specimens came from the forests of Siberia, "voisines de l'Enisséi," but it seems unlikely that it is subspecifically the same as the more northern animal, especially in view of Radde's statement (1862, 'Reise,' I, p. 45) that specimens from the Amur region are larger and darker than those of the Baikal district. Until topotypes of *sibirica* are available for comparison therefore, Milne-Edwards's name may be adopted for the very pale-yellow form of the dry area of North China. In fresh winter pelage, the body is very pale, about "pinkish cinnamon" (Ridgway, 1912) above, paling to "cinnamon-buff" below, the tail somewhat more intensely colored, about "orange-cinnamon" (specimen from Fengsiangfu, Shensi, November 23); while late-winter specimens are even paler. The collections include

skins from Chimo (Shantung Province), Kwei-huacheng (Shansi Province), and Fengsiangfu (Shensi Province). There are also two adult males in the Museum of Comparative Zoölogy from near Taiyuanfu, Shansi.

***Mustela sibirica davidana* (A. Milne-Edwards)**

Putorius davidanus A. MILNE-EDWARDS, 1870, *Nouv. Arch. Mus. d'Hist. Nat.*, Paris, VII, Bull., p. 92.

The yellow mink of southeastern China is much more intensely colored than that of northern China, almost "ochraceous-orange" (Ridgway, 1912) in fresh winter pelage, and tail not differing from the back. Summer specimens are darker, almost "ochraceous-tawny." Milne-Edwards's name *davidana*, based on a female from Kiang-si Province, is available for this form, the range of which extends from Shanghai west nearly to the borders of Szechwan and south in Fukien Province to Amoy, where Swinhoe mentions it as frequenting the walls of houses in pursuit of rats. The collections of the Asiatic Expeditions include skins from Foochow and Futsing (Fukien Province) and Ching River (Hupeh Province), while the Museum of Comparative Zoölogy has skins from Soochow (Kiang-su Province) and Ichang (Hupeh Province).

***Mustela sibirica moupinensis* (A. Milne-Edwards)**

Putorius moupinensis A. MILNE-EDWARDS, 1870, *Nouv. Arch. Mus. d'Hist. Nat.*, Paris, VII, Bull., p. 92.

In the highlands of western China this species is represented by a much darker form having a contrastingly dark tail-tip. The brownish of the forehead extends back along the median part of the back, which in the other races mentioned is pale. The dark tip to the tail is present in all the skins examined, which includes six from Wanh-sien, two from Tachiao, and one from Washan, in Szechwan, and one each from Talifu and Lichiang in Yunnan. The last locality is at an altitude of 12,000 feet.

Milne-Edwards, in describing these forms, gave them all specific status and apparently did not recognize the fact that females are considerably smaller than males. The westward range of this race probably is continuous with that of the smaller Nepalese *sub-hemachalana*, which may eventually prove also to be a subspecies of *M. sibirica*. Thomas indicates further that his *M. hamptoni* from Mt. Imaw Bum, northern Burma, is closely related to *moupinensis*, if not identical with it.

***Mustela kathiah* Hodgson**

Mustela (*Putorius*) *kathiah* HODGSON, 1835, *Journ. Asiatic Soc. Bengal*, IV, p. 702.

A weasel with tail slightly more than one-half the length of head and body; dorsal surfaces and tail all around uniform dark brown; lips and chin white; throat to wrists and ankles bright yellow, sharply delimited at sides.

A series of eleven weasels from Yenping and Futsing, Fukien Province, evidently represents Matschie's *Arctogale melli*, described from the adjoining province of Kwangtung, but I cannot see that they differ in any way from *M. kathiah*, of Nepal, to which the yellow-bellied weasel of Szechwan is currently referred. A single immature specimen from Lichiang, Yunnan Province, 9000 feet, is quite the same, so that, as in the case of *Charronia flavigula*, this weasel seems to have a wide range from northern India across southern China, without important change in color or size. There seems to be no doubt that Milne-Edwards's *Putorius astutus*, based on a weasel of this group from Moupin, Szechwan, is identical with the species here considered. He mentions that its fore feet are white on their upper surface, but this is not true of the Yunnan specimen, nor apparently of Nepalese specimens, though Hodgson mentions one from western India that had partly whitish feet. Matschie makes the wholly dark feet of his Kwantung specimen the chief distinctive character of *Arctogale melli*, but this is probably a matter that may vary individually. Yet none of the Fukien series has any white on the feet. Trouessart, describing a skin from Fukien, collected in 1874 by David, likewise states that the feet are dark like the back, while of three others from Ta-tsien-lu, Szechwan, supposed to be winter specimens, two have white toes and the third only "un peu de jaune" on the external side of the feet. Thus, while Szechwan specimens may or may not have white feet, it seems that those from Nepal, Yunnan, and Fukien do not so far as available evidence goes. Farther north, however, white on the feet is apparently the usual condition.

As to seasonal variation, the Fukien series is about equally divided between summer and winter skins, yet there is very little difference between those of July and those of December. The latter are, however, a very little paler above, more buffy, especially the underfur. The intensity of the yellow on the lower side varies individually from buff to deep ochraceous.

***Mustela pygmæa* (J. A. Allen)**

Putorius (Arctogale) pygmæus J. A. ALLEN, 1903, Bull. Amer. Mus. Nat. Hist., XIX, p. 176.

Very small, tail about as long as hind foot; above, including tail,

brown; below white, including upper lip, fore feet (except center of backs of hands), the inner side of hind legs, and terminal half of hind foot.

Three summer skins taken in the vicinity of Urga, Mongolia, agree perfectly with the original description of this species, the type of which came from Gichiga, on the Okhotsk Sea, Siberia. One, a male, is from 15 miles north of Urga, the second is from 45 miles northeast of that city, while the third, a female, is without precise locality. This, is therefore, a considerable extension of the known range to the southwestward. Kuroda, in 1921, announced the discovery of a weasel of this type from northern Hondo, Japan, and named it *Mustela rixosa namiyei*. The female of the three Mongolian specimens has four small brown spots medially on the chest. One, a male, measured: total length, 177 mm.; tail, 20; hind foot, 24; ear, 16; the female, total length, 158; tail, 17; hind foot [? 20]; ear, 10. No doubt the relationship of this weasel to the American *M. rixosa* is very close.

HELICTIS Gray

Ferret-badgers

The ferret-badgers are distinguished externally by their somewhat weasel-like form, though they are less slender, their strong fore claws, greatly developed cartilaginous snout, and their color which is brownish gray above, more or less hoary, white below, and with white facial markings on forehead, cheeks, and ears, often with more or less of a white median line extending from the nape spot to the shoulders. They are of special interest since the several species of eastern Asia are very much alike externally but are very different in cranial characters. Thomas (1922) has lately summarized these points and recognizes three genera for the Indian, Chinese, and North Bornean ferret-badgers, but in view of the quantitative nature of the characters it may be better to regard these divisions as of subgeneric value only, for the species are obviously nearly allied. The Indian *Helictis personata* represents then the subgenus *Melogale*, distinguished by its heavy teeth, the lower second premolar disproportionately larger than the first, and the upper carnassial with its external edge convex instead of practically straight. A smaller race occurs in Tonkin, and probably will be found to reach the southern borders of Yunnan, *Helictis (Melogale) personata tonquinia*; another small-toothed subspecies *H. (M.) personata laotum*, is named from north-eastern Siam. This subgenus is further distinguished from typical *Helictis* (type *H. moschata*), by the characters of the baculum or penis bone, which, as Thomas points out, is bifid terminally, with the prongs thick-

ened, one forming a curved crest, whereas in *H. moschata* the tip is trifid, with the slightly thickened terminal prongs set in a triangle. There is evidence that this difference is not so trenchant as might appear, for in a baculum of *H. (M.) p. tonquinia* in the Museum of Comparative Zoölogy there is, in addition to the two large thickened lateral prongs, a small ventral knob representing the third one, that is more fully developed in *H. moschata*. An additional peculiarity of *Melogale*, not mentioned by Thomas, appears very clearly on laying out the series of skulls available, namely, the very different character of the temporal ridges. In *Melogale*, these are heavier and more nearly median, curving strongly inward from the supraorbital processes so that their point of closest approximation is about the diameter of the orbit behind these processes, and from there back the ridges diverge very slightly. In *Helictis* as represented by the *moschata* group, the ridges are less heavy, much wider apart, and either parallel or slightly bowed outward over the braincase, occasionally converging at their posterior ends.

The close similarity of these two species makes it seem likely that their geographic ranges are mutually exclusive or nearly so. Anderson (Zool. Res. Yunnan) long ago recorded *H. moschata* from western Yunnan, but the specimen is possibly referable to the animal Thomas named *millsi* of Assam, no doubt to be regarded as the westernmost race of *H. moschata*. A further interesting point is the occurrence of a smaller species, *H. taxilla* Thomas, closely resembling *H. moschata* but of very much less size. Originally discovered in Tonkin, French Indo-China, the collections made by Mr. Clifford H. Pope for The American Museum of Natural History have resulted in extending its known distributon to Fukien Province, a thousand miles to the northeast, where it is represented by the large-toothed race described below.

***Helictis moschata* Gray**

Helictis moschata GRAY, 1831, Proc. Zoöl. Soc. London, I, p. 94.

The type locality is Canton, Kwangtung Province, South China, where the original specimen was secured by John Reeves. A series of 17 skins and skulls, secured by Mr. C. H. Pope in Hainan, is provisionally referred to the typical race in the lack of specimens from elsewhere in South China for comparison. Dr. J. A. Allen, in his list of the mammals of Hainan, follows the same course.

***Helictis moschata ferreo-grisea* Hilzheimer**

Helictis ferreo-griseus HILZHEIMER, 1905, Zoöl. Anz., XXIX, p. 298.

The type is a skin purchased in Hankau, Hupeh Province, and no doubt came from that general region. If the Hainan skins are correctly referred to typical *H. moschata*, those from Fukien and eastern Szechwan represent a larger race with grayer tone to the pelage, for which Hilzheimer's name is available. The average measurements of a series of skulls show that the northern animal is larger by several millimeters in most of its dimensions and the color is usually without the buffy tint to the white under parts and pale bases of the hairs above, though occasional specimens agree with the more southern animal in the pale orange suffusion of the lighter areas. Males average a very little larger in cranial dimensions than females. Specimens were secured at Futsing, Yenping, and Chunganh sien in Fukien Province, and at Wanh sien in eastern Szechwan, and Yochow, Hunan.

***Helictis taxilla sorella*, new subspecies**

TYPE.—Adult male, skin and skull, No. 85030, American Museum of Natural History, from Futsing, Fukien, China. February 21, 1926. Clifford H. Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Externally similar to *H. moschata* in general appearance, but much smaller, the ears slightly larger in proportion, the claws of the fore feet slightly more curved, the metatarsal pads shorter; the skull is relatively more slender, less inflated, and with a narrower muzzle. From typical *H. taxilla* of northern Tonkin this Chinese race is distinguishable by its smaller skull in combination with the large size of the teeth, which are even slightly larger than in *taxilla*.

COLOR.—pale chocolate-brown above, becoming hoary on the sides; tail long-haired and narrow, the chocolate hairs predominating on the basal half, the white-tipped ones on the distal portion. The pelage above has the proximal part of the hairs dull whitish. Notwithstanding that the white and dark head-markings are "about as in *moschata*" (Thomas) the four specimens from Fukien differ from that species in the following points: the white interorbital spot tends to be more linear than broad (in one it extends from nose-pad to crown as a broad line); the cheeks behind the eye are grizzled chocolate-gray and whitish, whereas in *moschata* a distinct dark spot extends backward from the posterior corner of the eye and is surrounded above and below by an area of clear white; finally a third distinctive mark of *moschata* is the presence of a small elongate chocolate spot beginning about 5 mm. behind the angle of the mouth and embracing a small clump of dark vibrissae, but in the four specimens of the smaller species this spot is without exception absent and the corresponding vibrissae are white or poorly developed. The ventral surface of the body, including the fore legs to the wrist and the hind legs nearly to the ankles, is dull white. Inside of ears and their outer rim whitish.

SKULL.—This is a replica on a smaller scale of the skull of *H. moschata* but, as Thomas has pointed out in his description of *H. taxilla*, it is more slender, especially in the rostral part, with a low and less inflated braincase. The female, however, seems to have a slightly more inflated skull than the male. The temporal ridges are wide

apart and nearly parallel. The tooth rows are very nearly as long as in *H. moschata* and slightly longer than in *H. taxilla*, but the individual teeth are as large as in the former species, resulting in a more slender attenuate rostrum for their accommodation. The distance between the upper molars equals the width of the postpalatal tube whereas in the larger *H. moschata* it exceeds that width.

MEASUREMENTS.—The collector's measurements of the type and a female topotype are respectively: head and body, 330, 320 mm.; tail, 140, 150; hind foot, 40, 40. In the dried skin the hind foot without claws measures in each 45 mm.

The skull of the type measures: greatest length, 71 mm.; basal length, 63.8; palatal length, 33.6; orbit to tip of rostrum, 24.8; zygomatic width, 37.0; mastoid width, 30.2; width across outer corners of molars, 18.2; interorbital width, 16.3; depth of braincase including bulla, 25.2; upper cheek teeth, 23.0; lower cheek teeth (canine to molars inclusive), 27.0.

This smaller species bears so close an external resemblance to *H. moschata*, that it may easily be confused with it. A close examination, however, shows that in addition to its smaller proportions, it differs in the gray instead of white cheek markings, the lack of a rictal dark spot, the much shorter metatarsal pads, and the weaker and slightly curved instead of nearly straight fore claws. In the case of two species so alike in structure living in the same region, one suspects a difference in habits, and it may be that the last two points indicate modifications for tree-climbing instead of terrestrial life.

***Meles meles leptorhynchus* Milne-Edwards**

Meles leptorhynchus MILNE-EDWARDS, 1867, Ann. des Sci. Nat., Zool., (5) VIII, p. 374.

A badger with the under side from chin to root of tail and the feet blackish to blackish brown. A white stripe from the angle of the mouth on each side to and beyond the base of the ear, and a median one from muzzle to eyes or occiput, as well as a blackish stripe from muzzle including the eye; all merge at the back of the head in the grizzled black and buffy white of the rest of the dorsal side.

The black instead of white throat and the white instead of grizzled tail distinguish skins of this genus at a glance from those of *Arctonyx*. Compared with the European badger, the Chinese form has the white facial stripes shorter and the pale tips of the hairs above are less extensive and tinged with buffy instead of being pure white. The median white stripe on the muzzle is usually clear and broad to or slightly past the level of the eyes, beyond which it becomes smoky brown or even heavily brown, but in one of eleven skins is darkened quite to the nasal pad. Matschie's *M. tsingtauensis* is based on a nearly normal specimen with the stripe

extending to the eyes. Matschie's *M. hanensis* and *M. siningensis* are also synonyms, based on slight individual variations in color.

The relationship of the Chinese badger to the European *M. meles* seems, on examination of a series of both, to be not more than subspecific. The color pattern is the same, except that the white head-markings are more obscured in the former, and its general tone is a little more buffy. The European animal is distinctly larger of skull with a better developed median crest. It also may occasionally have the first upper and first lower premolar (p^1 and p_1) present as small spicules but more often the upper one is altogether lacking and the lower one frequently, while in old age both are deciduous. In the Chinese badger, on the other hand, there seems to be no indication that the first small premolar is ever present, for in all the specimens at hand there is not even a space where it might stand in the toothrow. The slightly greater inflation of the bullæ is noticeable in Asiatic specimens, even in those of Asia Minor, which thus afford an intermediate condition.

***Arctonyx collaris collaris* F. Cuvier**

Arctonyx collaris F. CUVIER, 1825, 'Hist. Nat. des Mamm.,' pt. 51 (2 pp., Pl.).

A large, short-limbed badger, with pale claws; a white forehead stripe, and a shorter one below the eye; throat, ears, and tail white; feet and belly black. The fur of the back is basally white with a black terminal portion, or the black band may be succeeded by a white or a yellowish tip, so that specimens from the same locality may be black-backed or largely grizzled gray, often with a yellowish tinge.

The precise relationships of the Asiatic hog-badgers still require to be more carefully worked out with adequate material. The collections of the Asiatic Expeditions include fourteen skins and eight skulls from various localities in China and these show a considerable amount of variation which seems individual rather than geographic. Skins from the same region vary in color from those having white head-markings and black nape and back (with white bases to the hairs) to those with the facial markings tinged with ochraceous, the nape, shoulders, and all the hairs of the back white-tipped or ochraceous-tipped. A light-colored specimen of the latter type served as the basis for Thomas's *A. leucolæmus oreates* from the Tsingling Mts., Shensi. I cannot see that specimens occurring from Yunnan across South China to Fukien differ materially from *A. collaris* of Bhutan, judging from descriptions of the latter, and allowing for certain inaccuracies in the original figure as to the thinly

haired tail. Anderson, who examined the type of *A. obscurus* from western China, regarded it as a young animal identical with *A. albogularis*, itself doubtless the same as *A. collaris*, and Milne-Edwards also admits the close similarity. Wroughton in his summary list of Indian mammals (1919, Journ. Bombay Nat. Hist. Soc., XXVI, p. 347) states that the greatest length of skull in *A. collaris* is 135 mm., which is almost precisely that of adult skulls from Fukien (condylobasal length 135.7–136 mm.). Thomas, in 1922, described as *A. obscurus incultus* an old male from Anhwei, which differs in its thin coat and the great inflation of the sides of the posterior tubular part of the palate. The former character, however, is likely to vary seasonally as it obviously does in the Fukien and Yunnan skins, while the degree of inflation of the palate varies considerably in skulls from the same locality in Fukien. I am, therefore, regarding all the specimens in the present series from Lichiang, Yunnan Province, and from Chungan, Yenping, and Futsing, Fukien Province, as *A. collaris collaris*.

***Arctonyx collaris leucolæmus* (A. Milne-Edwards)**

Meles leucolæmus A. MILNE-EDWARDS, 1867, Ann. des Sci. Nat., Zool., (5) VIII, p. 374.

Smaller than the typical form, skull with condylobasal length of 123 mm., the white collar usually complete; the dark color of the back extending on to the basal part of the tail.

Three skins labelled from Chihli Province represent this slightly smaller subspecies. In Milne-Edwards's figure of the type from the environs of Peking, the white collar extends broadly across the nape, passing gradually into the grizzled, white-tipped hairs of the back. The three skins above noted show this collar but the entire back is black, lacking the white-tipped hairs. The skulls of two of these (labelled males) are aged and considerably smaller than those of South China animals, with the posterior tubular part of the palate hardly inflated at all. They agree in small size with the type skull as figured by Milne-Edwards. The third skin is not accompanied by a skull. In 1923, Lönnberg (Ann. Mag. Nat. Hist., (8) XI, p. 322) described as *A. leucolæmus milne-edwardsii* a hog-badger from the Minshan, southern Kansu, the chief characters of which are the black instead of grizzled dorsal surfaces, and the presence of a minute premolar (p^1 and p_1) in both jaws. He calls attention to a similar tooth variation in a specimen from Shensi recorded by Milne-Edwards. The skull of the type, a subadult female, is small, like that of Chihli specimens (123 mm. long), while the material now at hand shows

that the variations in color and in the presence or absence of the minute anterior premolars are altogether individual, for the skins from Chihli are similar in their black backs to that from Kansu, while of two skulls from Chihli, one has p_1 in the left lower jaw; and in six others from South China representing *A. c. collaris*, two have p^1 present in the left upper jaw, and all have p_1 on both sides in the lower jaws. It is obvious that this small tooth is in process of disappearance, and so is either quite absent or represented by a minute spicule, of varying size. The Minshan hog-badger is thus similar to that of Chihli and both seem to represent the slightly smaller, white-naped race, *A. collaris*, described by Milne-Edwards.

***Lutra lutra chinensis* Gray**

Lutra chinensis GRAY, 1837, Mag. Nat. Hist., (2) I, p. 580.

A clawed otter with the upper outline of the naked nose-pad W-shaped, instead of nearly straight across; general color light chocolate-brown, lips white, longer hairs of the lower surface white, the under-fur pale brown, whitish at base.

Two otter skins, one from Nodoa, Hainan, the other from Yenping, Fukien Province, are quite similar in color and evidently represent Gray's *L. chinensis*, the type of which was sent from China by Reeves, hence probably from near Canton. They are decidedly paler than European and Japanese skins of *Lutra lutra* and probably somewhat smaller, although the skulls indicate that the animals are hardly more than adult. The upper border of the nose-pad is W-shaped, with a decided central triangular point, as in the *L. lutra* group. It is probable that Matschie's *Lutra hanensis*, based on a trade-skin purchased in Hinganfu, southern Shensi, may represent the Indian and Burmese species, *tarayensis*, in which the outline of the nose-pad is nearly straight above as he describes it.

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VIVERRIDS FROM THE ASIATIC EXPEDITIONS¹

BY GLOVER M. ALLEN

The Viverridæ, or civets and their allies, is a family characteristic of tropical and subtropical climates where it largely takes the place of the Mustelidæ or weasels, although a few species extend northward into warm-temperate regions. The collections made by the Asiatic Expeditions, under the direction of Dr. Roy Chapman Andrews, include over two hundred skins, mostly accompanied by skulls, from South China, particularly from Hainan, Fukien, and Yunnan Provinces. Although these seem referable to but six species, the series of each is in most cases so large as to give an adequate idea of the range of individual, sexual, and geographical variation and to allow a fair estimate of the validity of sundry names bestowed in recent years upon certain Chinese specimens. Although no new forms were recognized it has seemed worth while to list the species taken, with critical notes on each.

Viverra zibetha Linnaeus

Viverra zibetha LINNÆUS, 1766, 'Syst. Nat.,' 12th Ed., I, p. 65; Bengal (see Thomas, 1911, Proc. Zool. Soc. London, p. 137).

The collection contains a magnificent series of over fifty civet skins, chiefly from Fukien and Szechwan, and includes five from western Yunnan (Lichiang, and Namting River); but in the absence of specimens from India they are all referred provisionally to the typical race, notwithstanding that several subspecific names have been proposed on the basis of one or several skins each. Thus, in 1864, Swinhoe described as *Viverra ashtoni* a specimen from Min River, Fukien Province, which lacked obvious cross-bands on the haunches and had the black dorsal stripe continued to the third dark tail-ring instead of ending (as commonly) with the first. Matschie, in 1908, renamed the Chinese civet *V. filchneri* on the basis of skins secured at Hinganfu, southeastern Shensi, claiming as distinctive characters the presence of wavy cross-bands on the haunches, six instead of five broader black and six narrower white

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 90.

tail-rings unconnected with one another dorsally (except that the basal dark ring is united medially with the dorsal stripe), a black tail-tip, a pronounced broadening of the middle dark neck-band, and smoke-gray underfur. More recently, Wroughton (1915, Journ. Bombay Nat. Hist. Soc., XXIV, p. 64) gave subspecific names to two supposed Indian races, *picta* from the Upper Chindwin River, Burma, and *pruinosa* from Little Tenasserim River, Burma. He later (1918, idem, XXVI, p. 46) regarded the former as untenable, but distinguished the latter race by its clear gray without a general yellow tinge to the ground color. Robinson and Kloss have since (1920, Rec. Indian Mus., XIX, pt. 4, p. 176) added another supposed race, *sagillata*, from peninsular Siam, differing in the sharper definition of its markings. Wroughton adds that one of his specimens from Upper Chindwin River is exactly like a skin in the British Museum from Shensi, while Robinson and Kloss maintain that specimens from Tenasserim are invariably more yellow than true *zibetha* instead of grayer as Wroughton claimed.

The present excellent series secured by the Asiatic Expeditions indicates that in all the characters mentioned there is considerable variation. In skins from the same locality, the usual buffy ground-color of the body may be replaced by clear gray—a mixture of white-tipped and blackish hairs; the pattern on the flanks may be extremely indistinct with every gradation to inobvious spots and blotches and even indistinct cross-stripes that become well defined on the rump. The number of rings on the tail is usually twelve, six white and six black, the terminal one black, but it may be five of each, while one from Yenping, Fukien, had no less than eight of each, the last three black ones very close together and separated by very narrow white rings. Usually only the basal black ring is connected dorsally by an extension of the median stripe of the body, but occasionally this may continue to the second or third and even beyond, showing as a few scattered black-tipped hairs. In specimens with a well-developed yellowish tint, it is usual to have the basal one or two black tail-rings provided with a pair of ochraceous centers, separated by the black median stripe. In one exceptionally bright skin from Fukien these centers are rusty in color and are indicated as scattered hairs of that hue on the third black ring. A single female skull from Hainan is slightly smaller in its dimensions than Fukien specimens.

It is obvious that all the characters hitherto used in the attempt to discriminate local races of the civet are subject to wide individual variation, and since there seem to be no striking differences in cranial measurements, I refer all Chinese examples to the typical form.

Viverricula malaccensis malaccensis (Gmelin)

Viverra malaccensis GMELIN, 1788, Linnaeus's 'Syst. Nat.,' 13th Ed., I, pt. 1, p. 92.

A medium-sized civet, grizzled gray and black with a blackish stripe extending along the side of the neck from the posterior base of the ear, and having five to eight narrow dark stripes on the back that become broken into lines of spots laterally; feet and a small crescent about the anterior part of the eye dark brown; tail with six to nine dark rings alternating with white or buffy-tinted rings.

The type locality is Malacca and, although several subspecies have been recognized, Wroughton, in 1918, writes that he has entirely failed in finding one that seems valid. The series now available through the work of the Asiatic Expeditions comprises fifty-eight skins, mostly with skulls, from Yunnan, Szechwan, and Fukien, and twenty from Hainan. The Hainan series is uniformly slightly smaller in size of skull and with one exception represents the gray phase of pelage, while the others are larger of skull, have longer tails, and are practically all of the rufescent type. Since the former series agrees in skull measurements with those published for typical *malaccensis*, I am referring them to that form, the range of which probably includes the entire Malay Peninsula to the Chinese border and Hainan, for Thomas has lately identified as of this race the specimens taken by the Delacour Expeditions. Females average a few millimeters shorter than males in length of cranium and of tooththrows.

Viverricula malaccensis pallida (Gray)

Viverra pallida GRAY, 1832, Proc. Zoöl. Soc. London, p. 63; 1834, 'Ill. Indian Zoöl.,' II, Pl. VI.

Similar to the preceding but the skull slightly longer in its dimensions (average condylobasal length of ten adult males 100.8 mm. against 95.6 in five adults from Hainan). Color averaging more ferruginous, tail longer, winter pelage longer and with less obvious stripes.

In his review of this genus in 1898, Bonhote regarded the Chinese animal as distinct, and used for it Gray's name *pallida*, based on the colored plate of a specimen sent by Reeves from China, though he published the same name earlier as a *nomen nudum*. While Reeves's animal probably came from the vicinity of Canton, and may therefore not be very different from typical *malaccensis*, yet the series from Fukien, not far to the northward, is so evidently different from the Hainan specimens taken as representing the typical form that it seems safe to apply Gray's name to them. This series of nearly sixty skins shows that the ferruginous phase is the usual one, and that the grayer type of coloring is

very rare. In winter skins the pelage is much longer than that of the more tropical animal and has the stripes and spots much obscured. The number of rings on the tail, which has been used as a distinguishing mark, varies within narrow limits from occasionally as few as six to rarely nine, or even ten.

Mr. C. H. Pope, who secured most of the Fukien series, says that this is chiefly a ground-living animal, frequenting thickets and covered ravines, whence it may easily be driven by dogs.

Its range in China extends north to the Yangtze Valley, where specimens were secured by Mr. Granger at Wanh sien. Two others from southern Yunnan seem to be the same, and differ in their narrow, less inflated bullæ from the only Indian skull available. It seems likely that *V. m. thai* Kloss of Central Siam will prove not distinguishable from typical *malaccensis* by which its range is surrounded.

***Paradoxurus hermaphroditus laotum* Gyldenstolpe**

Paradoxurus hermaphroditus laotum GYLDENSTOLPE, 1917, Kungl. Sv. Vet. Akad. Handl., Stockholm, LVII, No. 2, p. 26.

A series of eight adult skins from Hainan evidently represents the *hermaphroditus* group and, to this species, Dr. J. A. Allen has referred other Hainan specimens. The typical form, however, is restricted on the mainland to the southern portion of the Malay Peninsula, while in southern Siam (Trong) a slightly paler form is interposed, *P. h. ravus* Miller, 1913. Very recently Thomas has listed specimens from Annam as *P. birmanicus* Wroughton (type from near Sagaing, upper Burma), and it is unlikely that the Hainan specimens are very different for they agree fairly well with the description. Gyldenstolpe has shown, however, that his *P. h. laotum* is the same and was published over a month earlier, so that it is here used provisionally for the Hainan animal.

In the series of adults there are five distinct dorsal black stripes on a ground that varies from pale grayish buff to nearly golden. In one the entire throat to the upper chest and the sides and crown of the head are shining black, but in most these parts are much mixed with paler hairs; feet and tail black, the latter at its base more or less mixed with paler hairs, particularly on the lower side.

The only other paradoxure yet known from China is *P. exitus* Schwarz, from near Canton, a small animal, probably a race of *P. minor* Bonhote.

***Paguma larvata larvata* (H. Smith)**

Gulo larvatus H. SMITH, 1827, in Griffith's 'Animal Kingdom,' II, p. 281, Pl.

A palm-civet without stripes or tail-rings. Head and nape to shoulders black; a white blaze on forehead sometimes extending a varying distance on to the occiput or neck as a narrow line of white-tipped hairs. A white mark below and another above the eye extending to base of ear and below it, often to a nearly complete half collar. Upper parts and proximal portion of tail grayish to ochraceous; feet and terminal half of tail blackish brown.

With the fine series of over thirty skins secured by the Asiatic Expeditions, I have attempted to review the nomenclatural history of this species. The name *Gulo larvatus* was given, in 1827, by Hamilton Smith, to a specimen in the Leiden Museum, that had been so labeled by Temminck; his colored plate from the same specimen is a fair representation of the animal as we now know it from South China, but the original locality was unrecorded. Temminck who later, in his 'Monographies' (1841, II, p. 329, Pl. LXV, figs. 1, 2), described it as *Paradoxurus larvatus* and figured the skull, stated that it had been obtained from London. Gray (1831, Proc. Zoöl. Soc. London, p. 95; 1832, p. 67) had meanwhile redescribed the species on the basis of a specimen from the vicinity of Canton, China, sent by Reeves, referring it first to a new genus, *Paguma*, then to *Paradoxurus*. Of this specimen he published a colored figure (1834, 'Ill. Indian Zoöl.,' II, Pl. XI), which, though in many respects crude, is nevertheless again a fair representation. For nearly three-quarters of a century the name stood, until Matschie, in 1908, concluded that Hamilton Smith's figure was really that of the Formosan race (named *taivana* by Swinhoe), and hence he renamed the subject of Gray's plate *Paguma reevesi*. Thomas has shown the distinctness of the island race and (1909, Ann. Mag. Nat. Hist., (8) III, p. 377) that it does not really correspond to H. Smith's description as well as do specimens from the lower Yangtze; moreover, it is unlikely that at that early date a living palm-civet would have reached London from Formosa, but while Thomas does not say that Hamilton Smith's animal is identical with Reeves's, I think it may safely be assumed that they both represent the typical form of South China. Thomas then proceeded to describe a new race, *hainana* from the island of Hainan, and by a curious coincidence, Dr. J. A. Allen also described the same form using the same subspecific name. His paper was issued April 17, 1909, while Thomas's was received at Cambridge, Mass., on the previous day from England, so that the latter author must stand as authority for the name. In the following year, Wroughton described as *P. l. intrudens* a large brightly colored race from Yunnan and Burma, the type locality, Myitkyina, North Burma, less than forty

miles from the border of western Yunnan. In 1919, another race, *vagans*, with the hair of the upper parts black-tipped, was named from western Siam by Kloss, and finally, Thomas in 1921, added two more subspecific names, *yunalis* for the animal of western Yunnan, and *rivalis* based on a pale skin from Ichang on the Yangtze. As a basis for these various names, the material previously available has been admittedly inadequate, quite insufficient to indicate the range of variation in any single area. The series collected by the Asiatic Expeditions includes sixteen from Fukien Province, four from Szechwan, about 150 miles from Ichang on the Yangtze, a specimen from Chekiang Province, and eight (all but one without skulls) from western Yunnan. There is also a single young animal from Hainan. A careful consideration of this material makes it pretty certain that only two continental races are represented, namely, one from western Yunnan and the other from eastern Szechwan to the coast. The latter is the typical race, *larvata*: the former should probably stand as *intrudens*, of which *yunalis* would be a synonym.

The range of color variation shown by the Fukien series is considerable. The average skin has the entire back pale ochraceous buff, fading into nearly clear gray on the sides and belly. The underfur is smoky. The base of the tail is colored like the back, the terminal portion becoming black. The white blaze on the muzzle usually extends back between the ears and the whitish mark behind the ear seldom makes more than a narrow crescentic patch on either side. In the same series are individuals in which the ochraceous tinge becomes so reduced as to be practically wanting or in others very faint. At the opposite extreme are one or two in which the ochraceous tips of the body-hairs are so intensified that they are as bright as in the Hainan skin. While the black tip, on the average, includes the terminal half of the tail, in one it is only about a third, while three of the series (two from Fukien, one from Szechwan) lack the black tip altogether and have tails wholly gray or gray tinged with pale ochraceous. A specimen of this type from Kiating, Szechwan is recorded by Jacobi as *Paguma l. reevesi*, but he wisely remarks that it would be unwarranted to found a new race upon it, occurring, as it did, within the range of the typical form. The black tail-tip may be rather well defined, or it may extend as a darkened stripe nearly the whole length of the dorsal side of the tail. The amount of black in the subterminal portion of the longer hairs is further subject to much variation, while the exact extent of the white head-markings is hardly the same in any two skins. The usual condition, however, is to have the white frontal blaze continued back between the ears, but in at least two of the series (from

Fukien) it may be traced as a narrow line of white-tipped hairs nearly to the shoulders. A specimen from Wanh sien, Szechwan, however, has it well developed to the withers, approaching the condition found in *P. l. intrudens*. While usually more or less of the mustachial vibrissæ are white, in occasional skins they are all black. The chin is black, the throat mixed grayish.

This is an animal of the southern parts of China, hardly extending northward of the Yangtze basin. Mr. C. H. Pope writes that it is said to live in holes and is captured by being smoked out. Of the series secured in the Fukien and Szechwan Provinces, it is noticeable that a large proportion, though nearly full-grown, still have the well-developed milk dentition. This set of teeth evidently is retained for a considerable period, is perfectly functional, and not greatly inferior to the permanent set. Within narrow limits the individual teeth vary a good deal in size among specimens from the same locality and apparently independently of sex, so that too much reliance cannot be placed on the size of the teeth as a racial character. The peculiarly carinate audital bullæ are an interesting feature of the skull.

***Paguma larvata intrudens* Wroughton**

Paguma larvata intrudens WROUGHTON, 1910, Journ. Bombay Nat. Hist. Soc., XIX, p. 793.

Similar to *P. larvata* but larger, the back a brighter, deeper tone of ochraceous, the white mark of the forehead extended as a broad stripe to the shoulders, and the facial markings, including the whitish half-collar, more clearly defined.

The type locality is Sima, near Myitkyina, in northeastern Burma, a short distance from the borders of Yunnan, and marks very nearly the western bounds of the species' range. The slightly larger size of the type and of individuals from western China is indicated by the longer skull, 118-120 mm. from back end of occipital crest to gnathion, as against an average of 113 mm. in Fukien specimens. Wroughton considered the few available specimens from western Yunnan the same as his Burmese race, but Thomas in 1921 described as *yunalis* two individuals that were brighter in their ochraceous tint, and with very small suborbital white mark. The type locality is given as Yen-yuen-sien, Yunnan, but it is really in southern Szechwan, about 250 miles east of Wroughton's type locality.

The series of skins secured by the Asiatic Expeditions from Lichiang and the Namting River shows, however, that the white suborbital mark

is normally large and well defined instead of being a "mere vague streak," while the slight amount of variation in the ochraceous shade of the back is probably also chiefly an individual matter. I have therefore ventured to place the name *yunalis* in the synonymy of *intrudens*, which will be the name of the masked palm-civets of southern Szechwan to north-eastern Burma, south through western Yunnan to central Tonkin, whence Thomas has lately recorded specimens under the former name.

While the average skin of *intrudens* shows the white nuchal streak extending as a well-marked line to the shoulders, one from Lichiang has it very narrow and confined to the tips of the neck hairs, ending some 80 mm. from the posterior edge of the black shoulder area, while a second represents the opposite extreme, for the stripe, after continuing quite to the end of the black area, is interrupted for about 35 mm. and then continues indistinctly nearly the whole length of the back. Wroughton mentions a somewhat similar specimen. As in the typical race, an occasional specimen has an all-gray tail, without the black tip.

***Herpestes urva* (Hodgson)**

Gulo urva HODGSON, 1836, Journ. Asiatic Soc. Bengal, V, p. 283.

A large mongoose with coarse, grizzled pelage of black and buffy or whitish; feet dusky brown, tail becoming whitish to buffy or ochraceous in its terminal part; a conspicuous white stripe from the corner of the mouth to the shoulder.

The so-called crab-eating mongoose is found in the lower country of South China. The collection contains a skin from Chinkiang, a fine series of 27 secured by Mr. Clifford H. Pope and Rev. H. R. Caldwell in Fukien, as well as four taken by the former collector in Hainan.

Matschie in 1908 gave the name *Urva hanensis* to the Chinese animal on the basis of four skins from Hankow, which, although no specimens from India were available for comparison, appeared to differ from the original description in the following particulars: (1) chin brownish gray, much mixed with white, instead of being white; (2) underfur on the head dark brown with a gray tone instead of light reddish brown; (3) under side ochraceous, feet blackish brown instead of both under side and feet dull brown; (4) tail 250 mm., instead of 275-300 mm. In the matter of color, however, the series at hand shows considerable variation not only in the extent of the white tipping to the hairs, the amount of white or brown on chin, throat and feet, but also in the intensity of the buffy tint, so that in some the underfur is almost whitish, in others rusty, and the

basal portion of the long hairs on the tail varies between similar extremes. The measurement of the tail likewise seems not to be distinctive, so that until more obvious differences can be shown, Matschie's name is best regarded as a synonym. Of the four specimens from Hainan, two are immature, but the two adults are very dark in appearance due to a decrease in the extent of the white hair-tips and a corresponding increase in the black subterminal rings. One or two of the Fukien skins are indistinguishable, however, so that it is hardly feasible to separate the island animal.

***Herpestes rubrifrons* (J. A. Allen)**

Mungos rubrifrons J. A. ALLEN, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 240.

A medium-sized species; long hairs ticked black and buffy white giving a finely grizzled appearance; head washed with ferruginous, and the long hairs of the tail faintly tipped with ochraceous; backs of feet russet, belly yellowish drab.

Several additional specimens from Hainan represent this species, the relations of which are apparently with *javanicus* of Java or the mainland *exilis* of Tonkin and Siam. There seem to be no records of other species of mongoose than *H. urva* from the mainland if we except Hilzheimer's *H. albifer* based on skins bought at Hankow. These may even prove to be young of *H. urva*, though Hilzheimer believed they were related to *auro-punctatus*.

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CARNIVORA FROM THE ASIATIC EXPEDITIONS

BY GLOVER M. ALLEN

In previous papers, brief reports have been made on the Mustelidæ and Viverridæ secured by the Asiatic Expeditions under the leadership of Dr. Roy Chapman Andrews for The American Museum of Natural History. The remaining groups of Carnivora are here dealt with, including the bears, wolves, foxes, and cats (families Ursidæ, Canidæ, Felidæ) of which a magnificent series of skins and skulls was brought back, adequate in some cases for a tentative revision of the many names applied to certain eastern species. The discrimination of geographic races among the larger predaceous mammals is often difficult. Sufficient series from a single region are seldom available for the determination of normal individual variation in color, pattern, or proportions, which has resulted in the frequent bestowal of new names on a quite inadequate basis. Moreover, large carnivorous mammals may often have a wide individual range, so that local varieties are not so easily established as in the case of smaller and more sedentary species. So far as possible, therefore, I have attempted to review critically the various names and descriptions involved for the region covered.

Ursidæ

Selenarctos thibetanus (Cuvier)

Ursus thibetanus F. CUVIER, 1824, 'Hist. Nat. des Mamm.,' Pl. CCXIII and text.

The Asiatic black bear is given generic rank as distinct from the typical genus *Ursus* on account of its color (black with a white crescent on the chest), and the formation of the plantar pads, which in the fore paws have an enormous carpal pad continuous with the palmar pad, while of the digital pads the first and fifth only are continuous with the latter. The species is forest-living and occurs from India to Manchuria and South China. A number of local races have been named, but it must be admitted that the discrimination of most of these rests upon

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 91.

a very slender basis, since nearly all are described from single skulls, often of unknown age or sex and without adequate comparison with the typical form. In these large species not only is the individual and sexual variation in skulls so great as to be readily apparent, but the changes coincident with age are also striking. Moreover, these are wide-ranging animals, and a single one may travel over more territory in a day than a mouse or shrew would cover in its entire lifetime, a factor tending to prevent the ready development of local forms. Increasing age is accompanied by a great increase of zygomatic width, accentuation of the lambdoid and sagittal crests, and by the enlargement and deepening of the glenoid cavity of the jaw, so that the cranium of an old bear when placed on a flat surface rests upon the glenoid portion of the skull or the paroccipital processes, instead of upon the condyles as it does in immature animals. Age is also accompanied by a fusion of the cranial bones, so that in adults the outlines of the frontal, parietal, and finally the nasal bones become quite obliterated.

The Asiatic Expeditions secured four skins and skulls of black bears from the forests near Eastern Tombs, Chihli Province, which are thus topotypes of *S. t. wulsini* Howell. Unfortunately, the sex of none of these is known. Two are immature while the two others are adult, the larger perhaps a male. An adult female was also secured at the base of Tai Pei Shan, Shensi, and there are further, available for comparison, four adult skulls from northwestern Corea, Hupeh Province, and "India" respectively, the last representing typical *thibetanus*. A careful comparison of all these, and of the descriptions of *macneilli*, *mupinensis*, and *wulsini* reveals no single character whereby any local form of northern China may be distinguished. Sowerby (1920, Journ. Mamm., I, p. 213) has reviewed the bears of eastern Asia, particularly with a view to identifying those described by Heude, practically all of which he regards as valid species without recharacterizing them. He admits that *S. ussuricus* is much like *S. thibetanus* except that it "seems to have longer hair on the sides of the head and neck." The chief difference is believed to lie in the large size of the last upper molar, which in Manchurian specimens was 27 mm. long in a female, 31 mm. in a male, against 24 mm. in a female of *thibetanus* from the Himalayas and 28 mm. in a specimen representing *mupinensis*. However, in two skulls (unsexed) from India in the Museum of Comparative Zoölogy, representing *thibetanus*, the length of this tooth is 27 and 33 mm. respectively. In the Chihli series it varies from 28 to 32 mm. Evidently there is nothing diagnostic in the size of this tooth as a racial character. Lydekker's *macneilli*, from "some distance "

west of Ta-chienlu, Szechwan, was supposed to differ in its smaller cheek teeth, last molar 25 by 15 mm., but in a skull from Hupeh (M. C. Z. No. 11770) this tooth is 30 mm. long. In *S. t. wulsini* the smaller size of the white chin-spot as compared to *ussuricus* was believed by its describer to be diagnostic, but the series of topotypes secured by the Asiatic Expeditions shows that this, like most white markings in mammals, is very variable and may be large or small (varying in four skins from 45 to 130 mm. in length). In *mupinensis* it is also said to be very small. It is evident from a study of the available material and descriptions that individual variation will account for most of the supposed racial characters in the subspecies described, and that no truly geographic differences have yet been pointed out that will separate the Himalayan black bears from those of North China.

***Selenarctos thibetanus melli* Matschie**

Selenarctos melli MATSCHIE, 1922, Arch. f. Naturgesch., A, LXXXVIII, pt. 10, p. 34.

Matschie, in 1922, gave the name *melli* to a black bear from Kwangtung Province, near Canton, in South China. The type was captured as a cub, and kept for some three years in captivity, hence may be presumed to show the usual abnormalities of captive animals. Its chief character is said to lie in its small size, for it shows the usual color pattern of *S. thibetanus*. A fine skin and skull from Chunganhhsien in Fukien Province was secured by Mr. Clifford H. Pope of the Third Asiatic Expedition and may be regarded as of the same race. It is an adult male with the teeth much worn and all the cranial sutures quite obliterated. In size the skull about equals that of an adult female from Shensi, and since adult females are smaller than males, this may indicate that *melli* is really a smaller subspecies of South China. The single specimen from Fukien is obviously of much less size than the large skulls of *S. thibetanus* assumed to be those of males. The skin, taken in April, is in excellent condition and much shorter-haired than the winter skins from Chihli. If this specimen adequately represents the South China black bear, it seems to indicate a valid race, characterized by its smaller size and shorter coat. Mr. Pope also secured a very young black-bear cub from the island of Hainan that doubtless represents the same animal. Although long ago recorded from this island by Swinhoe, no adult specimens of the black bear seem to have reached museums from Hainan.

Canidæ***Canis lupus laniger* (Hodgson)**

Lupus laniger HODGSON, 1847, Calcutta Journ. Nat. Hist., VII, p. 474.

The wolf of Mongolia and northern China does not seem to be very different from the typical European race. Three skulls, one of a male, measure about the same as European skulls though none equals in size the large Swedish skull, the dimensions of which are published by Miller (1912, 'Mamm. Western Europe'). In color, the seven skins secured by the Asiatic Expeditions vary considerably according to season and condition of wear, but the best one, killed near Urga, is decidedly pale, the muzzle pale ochraceous-buff grizzled with whitish, forehead slightly darker, backs of ears and an area about their bases contrastingly orange-rufous, fore legs pale buff without trace of the dark stripe on forearm; neck, body, and tail with the usual ochraceous element reduced to buff, the white rings of the guard hairs prominent. Other Mongolian skins are considerably darker: buffy grizzled with black and the forearm stripe may be well developed. The underfur is thick and woolly, in the winter coat especially. In view of the variation in color among wolves of the same region, from pale grayish animals to buff-colored specimens with greater amounts of black in the pelage, it is evidently unwise to recognize several species among them as Matschie has done, unless more essential differences can be established than those shown in the native skins without definite locality which were made by this author the basis of his *Lupus filchneri* and *L. karanorensis*. He also names a third species, *Lupus tschiliensis*, on the basis of a skull, sex unknown, from Chihli, but the measurements are identical with those of Mongolian skulls and the slight differences in cranial proportions upon which he relies are best regarded as purely individual variations. Probably Hodgson's name *laniger*, based on the wolf of Tibet, is applicable to the wolf of Mongolia and North China, an animal very little paler and smaller than that of western Europe.

***Cuon rutilans* (S. Müller)**

Canis rutilans S. MÜLLER, 1839, 'Verhand. Zool. Zoogd.,' pp. 27, 51.

Size of a small wolf; color bright rusty rufous, the tail blacker with a black tip; belly, throat, and edge of upper lip usually white.

Two skins from Yenping, Fukien Province, taken by Rev. H. R. Caldwell, seem to be the first definite records for the province. They are not certainly distinguishable in color from two other skins from western Yunnan (Namting River and Shafun). One of each pair has the belly suffused with the reddish tint of the back.

The type locality of this animal is Bengal, but probably it is not very different from the earlier described *Cuon javanicus* (Desmarest) of Java, of which it may eventually prove to be the mainland subspecies.

***Nyctereutes procyonoides* (Gray)**

Canis procyonoides GRAY, 1834, 'Illustr. Indian Zoöl.,' II, Pl. I.

Small, fox-like, with short bushy tail; color a mixture of buff, gray, and black, the black-tipped hairs predominating over the back and in a narrow dorsal line from the crown to the tip of the tail; a conspicuous blackish-brown patch on each side of the face from just in front of and below the eye to a point midway to the ear and continued as a narrower line behind the ear. The flanks, sides of neck, and the tail are chiefly a warm buff; feet blackish brown.

Gray's original specimen was sent by Reeves from China, hence no doubt from near Canton. The large series of some twenty specimens, collected mainly by the Asiatic Expeditions, includes ten from Fukien Province which may be taken to represent true *procyonoides*. Three others from eastern Szechwan (Wanh sien) are quite the same, as are also those from Kiangsu, Chekiang, and Hunan Provinces. There is a wide variation in color among skins from the same locality, some having the black-tipped hairs of the back so numerous as to darken the whole upper side while in others they are chiefly confined to the median dorsal line. The entire pelage is more or less suffused with pale ochraceous which is in some skins intensified to a bright rusty. Winter skins in good condition are longer-furred than those of summer. A Fukien specimen taken in December shows the extreme of the intensification, in being almost fox-red all over except for the usual blackish areas and the black-tipped hairs of the dorsal line.

Matschie, in 1908, gave the name *stegmanni* to the racoon-dog of the Yangtze basin, type locality Chunkiang, at the same time stating that the *N. sinensis* of Brass, also from the Yangtze Valley was a synonym of *procyonoides*. The characters he gives (based on a single skull) are, however, unreliable and do not hold good in the present series, so that both these names are undoubtedly synonyms of *procyonoides*. No specimens are at hand from North China, so that it is uncertain if the species varies geographically in that part of its range. Matschie gives names, however, to the slightly larger Ussuri animal as well as to that from Amur Land.

Nyctereutes procyonoides orestes Thomas

Nyctereutes procyonoides orestes THOMAS, 1923, Ann. Mag. Nat. Hist., (9) XI, p. 657.

A slightly paler race. The type was an adult female from the north-western flank of the Likiang Range of Yunnan and constituted the first record of the genus in western China. Four additional skins (two with skulls) were secured from the same range by the Asiatic Expeditions, and show that the Yunnan animal is after all very similar to that of south-eastern China, differing chiefly in the gray instead of buff tene to the paler portions of the longer hairs, though there may be a very slight suffusion of buffy. The throat and feet are black in the type but brownish in the four other skins, while the nearly parallel condition of the zygomatic arches, which formed the chief basis of separation, is evidently an individual aberration since the two other skulls show nothing to distinguish them from those of the typical race. Thomas mentions the abnormal presence of an upper third molar on the right side in his specimen, a peculiarity found on the left side in a specimen collected by the Asiatic Expeditions in eastern Szechwan.

Vulpes vulpes hoole Swinhoe

Vulpes hoole SWINHOE, 1870, Proc. Zool. Soc. London, p. 631.

Similar to the red fox of Europe but the sides and especially the thighs more mixed with gray, the fore feet usually with less black, and the red tones less fulvous but more chestnut. The tail has the chestnut confined more to the upper surface; the lower surface is buffy white, its longer hairs black-tipped. Below, white to gray or even pinkish.

A series of seventeen skins, mostly with skulls, from Fukien Province is instructive as showing the range of individual variation in a restricted locality. Although the average skin is more chestnut above with grayer thighs and has a tail that is paler below, clouded with slaty, as compared with European red foxes (Scotland and Germany), nevertheless, there are occasional individuals that differ very little indeed from these latter. In general, the clear chestnut area is confined to a rather narrow median stripe with ill-defined boundaries, becoming more rufous on the tail. The flanks are bright ochraceous frosted with gray-tipped hairs which especially predominate on the sides of the haunches. The blackish area on the sides of the muzzle may be well developed or very indistinct or wanting altogether. The black stripe on the front of the fore leg is usually narrow, bordered by rufous, but may be broad enough to cover the entire front of the leg and extend up on the shoulders. In dark specimens

the throat and belly are suffused with slaty where the dark bases of the hairs show through, and in one skin the wearing away of the white tips of the hairs forms an indistinct black collar. Usually a narrow line of clear bright ochraceous runs along the sides bordering the belly. The last is usually white with grayish underfur, but occasionally the whole under side of the body is deep pinkish buff. In the entire series no skin shows the blackish belly so often seen in Egyptian or European red foxes. Swinhoe, however, found this variation in Fukien and believing it to represent an upland race, named it *lineiventer*. But there can be but little doubt that all the foxes of South China are really referable to a single subspecies to which Swinhoe's first name is applicable, for specimens secured by the Asiatic Expeditions from Chekiang, Hunan, and Maitai Chao, Shansi, do not show any essential differences. Matschie, in 1908, gave several names to foxes from eastern Asia, based on skins purchased in fur markets, but probably most of these are synonyms of *V. v. hoole* or of forms already described from eastern Tibet. His *Vulpes aurantio-luteus*, presumed to have come from the mountains of the upper Yangtze, is doubtless the same as *V. v. hoole*, with which it exactly corresponds in its description.

The average condylobasal length of four adult males from Fuching, Fukien, is 135.1 mm., of four females 127.8 mm.

A beautiful skin from Lichiang, Yunnan, is unusually deep in color, the fore and hind feet black, the entire back more fulvous than usual, and the tail much darkened with black. In its general appearance, however, it corresponds with *V. v. hoole*.

***Vulpes vulpes tschiliensis* Matschie**

Vulpes tschiliensis MATSCHIE, 1908, 'Wiss. Ergebn. Exped. Filehner, X,' pt. 1, p. 169.

A larger northern race of similar coloration to the last.

In describing this fox, Matschie supposed that its chief distinguishing feature lay in having the backs of the ears brown instead of black. The type is a mounted specimen from Peking in the Berlin Museum, and may have been somewhat faded, for another skin from the same locality, he says, has the ears blacker.

A single skin secured by the Asiatic Expeditions from Eastern Tombs, in the same province, can be closely matched by one of the less grizzled, fulvous specimens from Fukien. It has, however, a minimum of black on the feet, and lacks any dark mark on muzzle and chin. But its skull is so much larger than in any of the Mongolian or South China foxes, and in

this respect seems to agree so well with the cranial measurements given by Matschie, that it may perhaps represent a distinct northeastern race and I am therefore retaining Matschie's name for it. The condylobasal length is 157 mm., which is 22 mm. greater than the average of four male skulls from Fukien. Skulls from Shensi and Shansi are of intermediate size to 148 mm. for condylobasal length.

This skull is but little inferior in size to one recorded by Ognev from southern Ussuri, eastern Siberia, under the new name *dolichocrania*, the greatest length of which is given as 167.1 mm., while the same dimension (occiput to front of incisors) in the Eastern Tombs skull (A. M. N. H. No. 57070) is 165 mm. It may, therefore, prove that *tshiliensis* ranges to the Ussuri region and that Ognev's *dolichocrania* is a synonym of it.

***Vulpes vulpes* ?*karagan* (Erxleben)**

Canis karagan ERXLEBEN, 1777, 'Syst. Règne Anim.,' p. 566.

A pallid form, straw-yellow, with rusty on back, neck and shoulders; the paws straw-yellow, with or without black marking.

The collection contains an adult male skin and skull from Tsagan Nor, a skull from Loh, and two young from Tze Tzen Wang, Mongolia, as well as a skin from the Tianshan Range, but all these skins are in such poor condition of pelage through wear and moult, that their true coloration is undeterminable. The feet and noses of the adults, however, appear to be much paler in color than in the more southern foxes of China, so that the specimens doubtless represent a more pallid race, probably close to *V. v. karagan* of the Kirghiz Steppe. In his recent review of the foxes of Russia, Ognev mentions a skin collected by Koslov near Kiakhia and another from the steppes of southern Transbaikalia that seem practically indistinguishable from this race, but it is not clear that the additional forms he names as *V. v. ochroxantha* (Tian-Shan) and *V. v. jakutensis* (south of Yakutsk) are really very different. I am therefore provisionally regarding the Mongolian red fox as *V. v. karagan*.

Felidæ

***Felis bengalensis bengalensis* Kerr**

Felis bengalensis KERR, 1792, 'Animal Kingdom,' p. 151.

A dozen skins from Lichiang and Wei-shi, Yunnan, are referred to the typical race of the small spotted tiger-cat which, according to Wroughton, is found in India from southern Beluchistan to Upper Burma and Tenasserim. Although about the size of a house cat, it may at once be distinguished by the pale mark on the middle third of the back

of the ear and by the absence of a dark tip to the tail. Its essential pattern consists of stripes and spots on an ochraceous ground, as follows: two narrow black stripes, one from the posterior corner of the eye, the other from just below the eye, pass back along the side of the jaw enclosing a white area between them; the lower stripe is more or less continuous across the upper throat with the corresponding one of the opposite side and there are three or four other imperfect blackish-brown collar-marks on the lower throat; a short white stripe borders the inner and upper edge of the eye; four narrow black stripes run from the upper corner of the eyes to the shoulders, with sometimes a narrow median one on the forehead and crown; the two outer of these become broader posteriorly breaking up into large lengthwise blotches over the shoulders; the inner pair likewise becomes interrupted at the shoulders, but from there is traceable as a nearly continuous pair of stripes to the root of the tail; the sides of the body are marked by about five longitudinal rows of elongate spots which may be all black, or more or less surrounded by ferruginous, or the anterior part of the spot may be of the latter color, the posterior part black. These markings are larger in the males than in females. The belly has a number of blackish-brown spots on a white ground. The tail is buffy with ten or more broken rings of blackish.

In the Yunnan series, the ground color is bright buff or yellowish, sharply marked off from the belly which is white. There is a good deal of ferruginous on the shoulder region, not only tinging the ground color but broadly edging the spots and markings. In extreme specimens the body spots may be chiefly bright rusty slightly and incompletely bordered with black, while at the opposite extreme are skins in which the ferruginous is nearly suppressed, so that the markings are nearly all black on an ochraceous-buff ground. To this latter type belongs the skin described as *Felis anastasie* by Satunin, as Lönnberg has recently intimated.

***Felis bengalensis chinensis* Gray**

Felis chinensis GRAY, 1837, Mag. Nat. Hist., I, p. 577.

Similar to the typical race in all respects but the back is less clear ochraceous, with a decided gray tinge, and the flanks are grayish.

The collections include a large series of some thirty skins and nearly as many skulls from eastern Szechwan (Wanh sien), Hunan (Yochow), Fukien (Futsing and Yenping), Hainan (Nodoa), and a few other places. They all agree in the somewhat grayish tint to back and sides instead of the clear warm buff to ochraceous of the typical animal. There is much

variation in the pattern and size of the markings. Males are larger, with larger markings than females, and in old age the skulls have a low sagittal crest formed by the union of the temporal ridges, whereas in none of the females seen does this ridge form. Peculiarities of the teeth are the frequent loss of the first upper premolars and in the upper carnassial (p^1) the antero-internal lobe is often much reduced in size or it may even (as in a case noted by Lönnberg) be practically suppressed. In old animals the orbit may be closed by the fusion of the postorbital process with the ascending process of the jugal.

Milne-Edwards's *Felis scripta* is either based on this subspecies whose variation in markings is so deceptive, or it may possibly represent a slightly darker race. Probably also that author's *F. microtis* from near Peking is only a small female of the same, for the supposed reduction of the ears is said by Elliot, who examined the type (and spelled the name *macrotis*), to be fallacious, for they are really of normal size. A large skin, perhaps of a male somewhat stretched, but probably representing the same animal, became the basis of Milne-Edwards's *F. decolorata*, also from near Peking. It may later prove that the tiger-cat of North China is a distinct race, in which case the name *microtis* will be available for it, provided this in turn is not identical with Radde's *F. undata* of Amur Land, which is at most a geographical race of *bengalensis*. In the lack of comparable material from North China, however, this point cannot be settled now.

***Felis temmincki dominicanorum* P. L. Selater**

Felis dominicanorum P. L. SCLATER, 1898, Proc. Zool. Soc. London, p. 2, Pl. 1.

About twice the size of a house cat, yellowish brown to grayish brown above, the crown, neck and mid-line of the back bright ferruginous; two short white lines from the inner corner of the eyes continue as dull gray lines to the top of head; a white line from just below the eye to side of neck, bordered above and below by russet and black; backs of ears black mixed with gray centrally; a clear gray patch behind ear; feet grizzled gray; tail like the back, with a black tip and whitish lower median line; belly whitish with a row of dark spots on each side.

Four handsome specimens of this cat were secured by Pope in north-western Fukien. Its range no doubt is more or less continuous across the wooded mountainous parts of southern China to Nepal and the Malay Peninsula. The type locality of *F. temmincki* is Sumatra but no comparisons seem to have been made between Sumatran specimens and those of China, though Lönnberg has shown that a skull from northern Siam is

practically identical in measurements with one from China. An adult skull from Nepal is slightly smaller with more inflated bullæ.

Lydekker in 1908 gave the name *Felis temminckii mitchelli* to the animal of Szechwan on the basis of a single skin, and in 1924 Sowerby described a specimen from Tengyueh, Yunnan, as *F. t. bainesi*. In view of the variation in color among cats, and the fact that the species, like *F. aurata* of West Africa, believed to be closely related, occurs in a rufous and a browner phase, it is likely that these are not valid races. Matschie's *Felis* (*Catopuma*) *melli* is undoubtedly a synonym of *F. t. dominicanorum*, as well as *F. t. badiodorsalis* A. B. Howell, proposed in place of *melli*, preoccupied.

In addition to the four typical specimens secured at Kuatun, Fukien, by Mr. C. H. Pope, he obtained a fifth (an adult female) from the same locality which agrees in size and in cranial characters with these but differs remarkably in that, instead of being without markings on the body, it has a distinct color pattern of stripes and spots. Like usual skins of *temminckii*, it has black ears, slightly grizzled with gray in the middle of their posterior side, a clear gray patch behind each ear, grizzled gray feet, and bright ferruginous shoulders and mid-dorsal area. The head and body, however, are marked with a pattern practically identical with that of *Felis bengalensis*. There are two narrow lines of black down the back with a less clearly marked pair external to them, then about four rows of elongate blotches and spots, each with an ochraceous center incompletely ringed by a broken black margin, heavier at the posterior side. A row of blackish spots is present on each side of the belly. The tail, in addition to the usual pattern of ferruginous above, white below, with a black tip, also has about fifteen black bars, much as in the smaller species. At first sight, this animal might be thought a hybrid between *F. t. dominicanorum* and *F. b. chinensis*, both of which occur together here, although the latter is commoner at lower altitudes, but it seems equally probable that it represents either a reversion to a more primitive striped and spotted condition or a retention of the pattern that is probably characteristic of babyhood.

***Felis nebulosa* Griffith**

Felis nebulosa GRIFFITH, 1821, 'Descr. Vert.,' p. 37.

Size of a leopard; the grayish-ochraceous ground color has some four or five large blotches on the sides, each outlined in black, forming a rim that is narrower or broken on the anterior side; forehead with many small black spots; two pairs of black stripes from occiput to shoulders,

whence the median pair continues more or less broken on to the base of tail; belly white with elongate blackish spots.

A skin from Yenping, Fukien, and another, smaller with the black marks less developed, from Hainan, represent this species. The slight differences in color and pattern are probably individual, and since Griffith's type was an animal supposed to have come from near Canton, the Fukien skin may be regarded as typical, and Matschie's *Felis* (*Neofelis*) *melli* from Kwangtung a synonym. Material is lacking to determine the status of the Sumatran animal to which Horsfield gave the name *F. macrocelis*.

***Felis pardus perniger* (Hodgson)**

Leopardus perniger HODGSON, 1863, 'Cat. Mamm. Nepal,' p. 3.

The type locality of Linnæus's *Felis pardus* has been fixed by Thomas as Egypt, and Hollister shows that skins from the southern part of that country are ochraceous buff, hence somewhat pallid, in ground color. African leopards seem to be either large-spotted or small-spotted, the latter perhaps the more usual condition. The series of eleven from Fukien and eastern Szechwan, secured by the Asiatic Expeditions, are uniformly rich ochraceous in ground color, with a pattern of large spots. There is a spinal series of large black spots forming two rows, while laterally the spots become more nearly circular, either with ochraceous centers completely ringed, or with the rings broken anteriorly or in two or three places. Immature specimens are paler in color than adults.

Although various names have been given to leopards in the East, it can hardly be said that any of them rests upon a satisfactory basis. Cabrera has pointed out that Hodgson's *Leopardus perniger*, based on a melanistic individual from Nepal, is the oldest name available for an Indian leopard, and since it is likely that the animal of South China is the same, I am provisionally using it for the latter. Three leopard skulls from India (two from Amballa) are a little different in the form of the nasals from the Chinese series, in which these bones are slightly more flattened and triangular, tapering to a median point behind instead of maintaining their width farther back and ending in an abruptly rounded outline. These differences are slight, however, and may not hold in a larger series of Indian skulls. Other available names for the eastern leopard are: *melas* of Péron and *variegata* of Temminck, both based on specimens from Java, Matschie's *Panthera hanensis* based on skins from Hing-an-fu and *Felis pardalis sinensis* of Brass applied to leopards of South China. The likelihood is, however, that the latter do not materi-

ally differ from Indian examples. Although specimens from North China are not available to determine the validity of the race currently called *fontanieri* (type locality Peking), Cabrera has suggested that the name *orientalis* of Schlegel (type from Amur) may be found applicable to it instead.

***Felis tigris* Linnæus**

Felis tigris LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 41.

Three handsome tiger skins with skulls, from Fukien Province, do not seem to differ essentially from the only Indian tiger available for comparison. The three are similar in their rich tawny ground-color, but differ in the details of the black stripes. In the adult male, No. 45519, the body stripes are broad, and much broken into lozenge-shaped blotches, with wide borders enclosing a bright rufous center. The stripes on the hips and haunches are, however, clear, wide, and continuous. A second skin shows the opposite extreme, with very narrow stripes, much less broken over the body, but tending to be short or incomplete; while the third is somewhat intermediate, with the stripes more broken and tending to form blotches open on the anterior upper part, enclosing areas of tawny. Hilzheimer (1905, Zool. Anz., XXVIII, p. 594), in comparing five Chinese tiger skulls with three from India, believed that the Chinese skulls could be distinguished by having the highest point of the skull just ahead of the postorbital processes instead of over them, and by lacking a small antero-external supplementary cusp on the upper carnassial, present in Indian skulls. These differences do not seem to hold good, however, for in the three skulls from Fukien the highest point is behind the postorbital process in one, ahead of it in the two others, while the supplementary cusplet of the upper carnassial is well developed in the large male, slightly developed in the second specimen and not at all in the third. Hilzheimer, relying on the report of an expert fur dealer, believed that there are differences in pelage between the Indian and the South China tigers, but it seems doubtful if these are of recognizable value in nomenclature, so that for the present Hilzheimer's name *amoyensis* for the tiger from Yunnan to Fukien may be regarded as probably a synonym. Following Pocock, I retain the generic name *Felis* for the tiger and the leopard, although both may be included in a subgenus, *Panthera*.

***Lynx lynx isabellina* (Blyth)**

Felis isabellina BLYTH, 1847, Journ. Asiatic Soc. Bengal, XVI, p. 1178.

A large short-tailed cat, of a general frosted reddish above, white below with a few blackish spots on inner side of fore limbs and on the

sides of belly; legs and flanks with indistinct reddish spots; a broad white border to the eyelid, interrupted by a black spot near posterior upper margin; cheeks with three or four indistinct stripes of reddish brown; upper half of ear, its terminal pencil, a black spot on the lower cheek, and the tip of the tail, black.

A large skin from fifteen miles northeast of Urga, Mongolia, is interesting as perhaps marking nearly the southern boundary of this lynx's range in this part of Mongolia, where the coniferous forest and its northern fauna reach the edge of the Gobi Desert.

Article VIII.—NOTES ON REPTILES FROM FUKIEN AND OTHER CHINESE PROVINCES¹

BY CLIFFORD H. POPE

PLATES XVII TO XX; TEXT FIGURES 1 to 19; 2 MAPS

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¹Publications of the Asiatic Expeditions of The American Museum of Natural History.
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INTRODUCTION

This is a preliminary report on the reptiles collected by the Central Asiatic Expeditions of The American Museum of Natural History, but not included in Karl P. Schmidt's 'Notes on Chinese Reptiles,' and 'Reptiles of Hainan' (American Museum Bulletin, 1927). Schmidt's reports deal not only with the earlier Central Asiatic Expeditions' collections but with all the other Chinese material in the American Museum as well.

'Notes on Chinese Reptiles' is a report including 1603 specimens from the mainland, all but 116 of which were secured by American Museum expeditions. 'Reptiles of Hainan' reports on 1580 specimens collected by myself on that island for the Central Asiatic Expeditions during 1922 and 1923.

The present paper deals with some 2700 specimens, the vast majority of which I collected in Fukien and Kiangsi Provinces during 1925 and 1926. Those from Chihli and Shantung Provinces were secured by Wang Fa-hsiang, a native collector whom I trained personally, while Walter Granger collected several very interesting specimens in Yunnan Province. A few others were secured through various sources.

I am deeply indebted to Dr. Roy Chapman Andrews for the opportunity of serving for four years on the field staff of his Central Asiatic Expeditions. Mr. Karl P. Schmidt has gone over my first draft of the manuscript in detail, and with him I have discussed every problem. Many of his suggestions have been incorporated in the paper, and he has corrected several mistakes and called my attention to numerous oversights. For his invaluable help I am indeed grateful. Dr. G. Kingsley Noble has read the manuscript, and discussed many points with me, thus rendering valuable aid.

SUMMARY OF MATERIAL TREATED

Listed systematically, the 2749 reptiles, representing 13 families, 48 genera, and 96 forms, are distributed as follows:

| TURTLES | Genera | Forms | Specimens |
|---------------------------------|--------|-------|--------------------|
| Platysternidæ | 1 | 1 | 6 |
| Testudinidæ | 2 | 3 | 50 |
| Trionychidæ | 2 | 2 | 80 |
| Total | 5 | 6 | 136 |
| LIZARDS | | | |
| Gekkonidæ | 2 | 5 | 229 |
| Agamidæ | 1 | 1 | 52 |
| Anguidæ | 1 | 1 | 32+ 4 ¹ |
| Lacertidæ | 3 | 4 | 263+ 6 |
| Scincidæ | 5 | 8 | 489+ 6 |
| Total | 12 | 19 | 1065+16 |
| SNAKES | | | |
| Typhlopidae | 1 | 1 | 5 |
| Pythonidæ | 1 | 1 | 1 |
| Colubridæ (<i>sens. lat.</i>) | 26 | 63 | 1421+7 |
| Hydrophiidæ | 1 | 1 | 3 |
| Crotalidæ | 2 | 5 | 118+2 |
| Total | 31 | 71 | 1548+ 9 |

The following table shows the number of specimens taken in each locality or group of minor localities.

| Locality | TURTLES | | LIZARDS | | SNAKES | |
|----------------------------------|-----------|-------|-----------|-------|-----------|-------|
| | Specimens | Forms | Specimens | Forms | Specimens | Forms |
| Futsing Hsien | 51 | 3 | 85 | 6 | 343 | 26 |
| Yenping | 1 | 1 | 224 | 9 | 288 | 26 |
| Ch'ungan Hsien | 6 | 1 | 459+16 | 12 | 599+9 | 45 |
| Other Fukien Localities | 30 | 5 | 1 | 1 | 22 | 8 |
| Kiangsi Localities | 14 | 2 | 30 | 3 | 47 | 14 |
| Chihli Localities | 12 | 1 | 113 | 2 | 135 | 6 |
| Shantung Localities | 21 | 2 | 136 | 2 | 93 | 5 |
| Yunnan Localities | 0 | 0 | 17 | 2 | 14 | 10 |
| Hunan, Mongolia, and Szechwan | 1 | 1 | | | 7 | 4 |
| Total | 136 | | 1065+16 | | 1548+9 | |

¹Numbers following plus signs refer to embryonic series.

LIST OF NEW FORMS AND TYPE LOCALITIES

LIZARDS

| | | |
|-----------------------------------|-----------------|---------|
| <i>Gekko japonicus hokouensis</i> | Hok'ou | Kiangsi |
| <i>Apeltonotus sylvaticus</i> | Ch'ungan Hsien, | Fukien |

SNAKES

| | | |
|--------------------------------------|-----------------|--------|
| <i>Pseudozenodon striaticaudatus</i> | Ch'ungan Hsien, | Fukien |
| <i>Pseudozenodon karlschmidti</i> | Ch'ungan Hsien, | Fukien |
| <i>Pseudozenodon fukienensis</i> | Ch'ungan Hsien, | Fukien |
| <i>Zaocys dhumnades montanus</i> | Ch'ungan Hsien, | Fukien |
| <i>Opisthotropis kuatunensis</i> | Ch'ungan Hsien, | Fukien |
| <i>Dinodon futsingensis</i> | Futsing Hsien, | Fukien |
| <i>Dinodon flavozonatum</i> | Ch'ungan Hsien, | Fukien |
| <i>Amblycephalus niger</i> | Yunnanfu, | Yunnan |
| <i>Hemibungarus kelloggi</i> | Ch'ungan Hsien, | Fukien |
| <i>Bungarus wanghaotingi</i> | Yuan Kiang, | Yunnan |

LOCALITIES MENTIONED IN THIS PAPER

The following table will serve to locate the places from which the specimens come.

| LOCALITY | SITUATION | PROVINCE |
|-----------------------------|---|----------|
| Amoy | Southeastern coast | Fukien |
| Ch'ienshan Hsien (Yuanshan) | Northeast, adjacent to Ch'ungan Hsien | Kiangsi |
| Ch'ungan City | On plateau of northwest | Fukien |
| Ch'ungan Hsien | Northwest, adjacent to Kiangsi | " |
| Foochow | Mouth of Min River | " |
| Futsing Hsien | On coast directly south and east of Foochow | " |
| Hok'ou (Hokow) | Northeastern corner | Kiangsi |
| Hsin Kai | Southwest of Yunnanfu | Yunnan |
| Kienning | On northern branch of Min River, north and a little east of Yenping | Fukien |
| Kienyang | On Ch'ungan branch of Min River, north and a little west of Yenping | " |
| Kolobolchi Nor | | Mongolia |
| Kuatun | Village in mountains of Ch'ungan Hsien | Fukien |
| Nanan | Extreme southwestern corner | Kiangsi |
| Peking | | Chihli |
| Pingshiang (Pingsiang) | Near western boundary | Kiangsi |
| San Chiang | Village in mountains of Ch'ungan Hsien, near to but lower than Kuatun | Fukien |
| Shaowu | Mountains of northwest; southwest of Kuatun | Fukien |
| Tsinan | North central; provincial capital | Shantung |
| Wanh sien | On Yangtze River, in extreme east | Szechwan |

| LOCALITY | SITUATION | PROVINCE |
|---------------|---------------------------------|----------|
| Western Hills | Just west of Peking | Chihli |
| Wu Ting Hsien | Southwest of Yunnanfu | Yunnan |
| Yenping | North central | Fukien |
| Yuan Kiang | Southwest; on Yuan or Red River | Yunnan |
| Yunnanfu | East central | " |

Cities of certain political importance are called "fu" cities. When writing the names of such the "fu" is often left off the end. For example, Yenping may be properly written Yenpingfu. It is immaterial whether many names are written as one or more words; for example, Wuting is the same as Wu Ting or Wu Ting Hsien. The suffix "hsien" indicates another grade of political importance and, like "fu," may be omitted. The area under the jurisdiction of a "hsien" or "fu" city also goes by the same name as the city itself. Ch'ungan may mean the city of that name or the area in which the city stands.

There is much confusion as to the proper romanization of Chinese names. I have used the spelling found on the Postal Map of China in nearly every case. Where I have departed from this accepted standard I have put in the list of localities the Postal Map spelling in parenthesis following the one I use.

After making a careful study of the Chinese reptiles in the American Museum, Mr. Schmidt was convinced that Fukien should be considered the key province for zoögeographic studies in Chinese herpetology. This is because it lies in an intermediate region, its northwestern part coming within the range of some northern and many central Chinese forms, its western mountain system bringing it into the typical Himalaya-Chinese distributional area, while its coastal plains are invaded by many purely tropical species. Moreover, it is in many sections almost untouched by the hand of man. In these regions primeval conditions prevail and wild life lives on in safety quite unconscious of the proximity of the most thickly settled and highly civilized sections of the earth, the alluvial plains of central and southern China.

Following Mr. Schmidt's advice I set out from New York in January, 1925, with Fukien as my objective. I did not arrive in Foochow until late in March. From April 1925, through September 1926, I continued to collect and study the reptiles, amphibians, fishes and mammals of northern Fukien. The amphibians and fishes will be studied later but reports on the mammals by Glover M. Allen are already appearing.

The following outline will give a more definite idea of my periods and places of active collecting.

| | | |
|----------------|------------|----------------------|
| Yenping | April 12, | through June 2, 1925 |
| Ch'ungan Hsien | June 12, | " July 20, 1925 |
| Futsing Hsien | August 24, | " October 5, 1925 |
| Ch'ungan Hsien | April 25, | " September 3, 1926 |

While working in Ch'ungan Hsien I sent a collector to Hok'ou, Kiangsi, to get the commoner forms there. Specimens from Ch'ungan City, Kienyang, Kienning, and Foochow were taken at odd times either by myself or one of the men directly in my employ.

The method of collecting was much the same everywhere. Immediately upon arrival at a new place I would ask if any professional snake catchers, fishermen, etc., lived near and if any were found I would try to hire them. Then my own collectors would organize all idlers and ambitious boys, and teach them to catch and bring in the rarer forms. In addition, they, themselves, would take turns going out to get specimens, but one or two always had to act as receivers in camp. My own time was largely reserved for reconnaissance, special night studies of habits, and so forth.

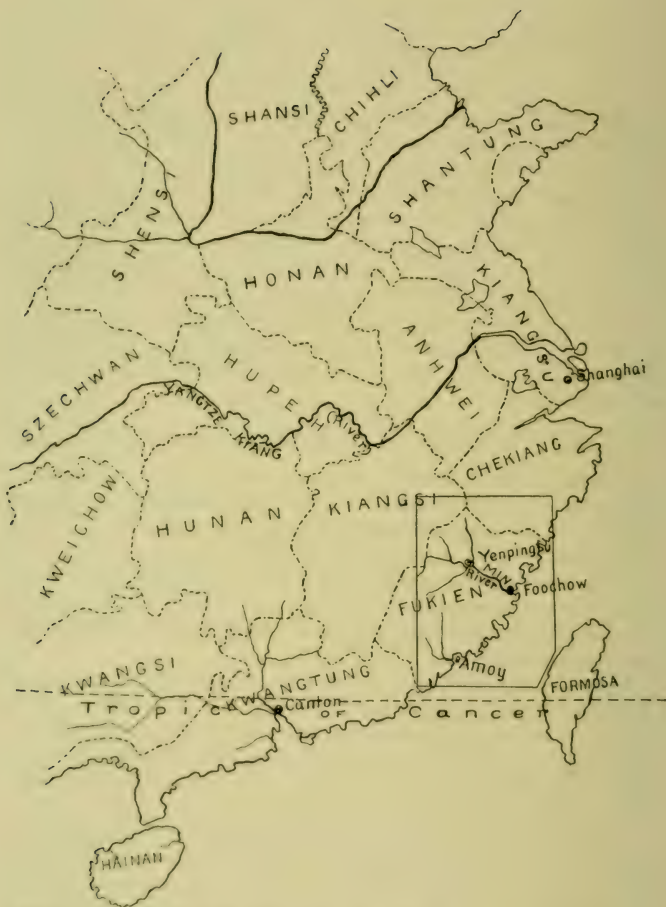
DESCRIPTION OF FUKIEN AND ITS THREE PRINCIPAL LOCALITIES

Fukien is one of China's "Eighteen Provinces." Located on the southeastern coast, it is bounded by the Formosan Strait on the east, Chekiang on the north, Kiangsi on the west, and Kwangtung on the south. It is roughly quadrangular in shape and set obliquely, the northwestern corner being a little east of the southeastern. With the exception of the four corners it lies wholly within the area bounded by the 24th and 28th parallels of north latitude, and the 116th and 120th meridians of east longitude.

In southeastern China, from southern Anhwei southward through Chekiang, Kiangsi (excepting the flat country in the Poyang Lake region) Fukien, and much of Kwangtung, there arise endless chains of steep, rugged mountains from three to more than seven thousand feet high. The wildest and highest ranges follow inland provincial boundaries, while along the sea the lowest regions are found.

It is obvious that an area lying just north of the Tropic of Cancer, having great altitudinal differences resulting from ranges extending often north and south, and an extensive coast line, would possess a rich and interesting fauna and flora. Fukien is just such an area and it will soon be shown that it is in nowise disappointing.

To the Chinese mind the name Fukien is almost synonymous with the word mountains. This, moreover, is a true conception. The deeply



Map 1.—Eastern China with approximate area of Map 2 enclosed by a rectangle.



Map 2.—Eastern Fukien showing the region in which intensive collecting was carried on by the Central Asiatic Expedition during 1925 and 1926.

indented coast, a result of subsidence, is no less rugged and hilly, though here the low mountains are broken by broad plains. The mountains increase and the plains diminish until, along the western border, high, steep ranges almost completely intercept transportation. In these mountains, peaks rise to 7000 feet or more, and sparsely settled, primeval forests abound. The ranges here in general extend from southwest to northeast. From the coast there is a general rise until in the northwest the mountains themselves take off from a plateau some 1200 feet above sea-level.

The northern half of the province, that region with which this paper directly deals, is drained for the most part by the Min River system. The headwaters of this river arise along the Fukien-Kiangsi boundary and descend as several streams before uniting at Yenping to form the Min.

The foregoing tables make it evident that only three localities are of relatively great importance. These are worthy of separate treatment. In order of importance they are:

CH'UNGAN HSIEN

Ch'ungan City, Kuatun, and San Chiang are all included in this area. In the neighborhood of Ch'ungan City there is a large, open plateau very highly cultivated. Interesting specimens are here extremely rare. Traveling westward one soon enters the Kuatun mountains where possibly the highest ridges of the entire Province are found. Kuatun itself is situated in a wide valley just below the highest peak of the region, while San Chiang, perhaps 1200 feet lower, is in a valley through which an interprovincial highway passes. The pass into Kiangsi is known as T'ung Mu Kuan.

Kuatun is famous as the collecting ground of both Abbé Armand David and Mr. J. D. La Touche. Mr. Outram Bangs of the Museum of Comparative Zoölogy, Cambridge, has supplied me with a list of 27 forms of birds with Kuatun as the common type locality. Seven reptiles have previously been described from there:

| | |
|-------------------------------|----------------------|
| <i>Ophisaurus harti</i> | La Touche Collection |
| <i>Natrix percarinata</i> | " " |
| <i>Natrix craspedogaster</i> | " " |
| <i>Tapinophis latouchi</i> | " " |
| <i>Trirhinopholis slyani</i> | " " |
| <i>Amblycephalus stanleyi</i> | Secured by Stanley |
| <i>Coronella bella</i> | " " " |

This by no means exhausts the Kuatun new species list but only serves to give a proper conception of the scientific importance of this remote mountain village.

I have thought it wise to substitute in this paper Ch'ungan Hsien for Kuatun. The former term is more accurate because of the extreme zeal of the Kuatun collectors. Large numbers of the snakes brought in by them were not taken about Kuatun but miles off in the neighboring mountains. People from nearby villages also supplied us in part and it was impossible to tell the exact direction the specimen had come from.

Boulenger records some lowland species as coming from Kuatun but in all probability they were taken by collectors when on a trip down to the plateau after supplies and brought back as local specimens. Even though these men move around locally on hunts, and when fetching plateau rice, they seldom leave the hsien, so the danger of wrong localities is negligible when hsien names are used.

YENPING

This city, situated where the main branches unite to form the Min River, has been visited by botanists as well as zoölogists. Caldwell, Sowerby, and Andrews have collected here with good results. The waterfront of the town is only about 500 feet above sea-level, while the forested mountains six or eight miles west of the city reach an altitude of more than 4200 feet. Thus specimens from a great range in altitude may be taken.

FUTSING HSIEN

In this area an even mixture of seaside plains and low, rugged mountains one to three thousand feet high is found. It lies immediately south and east of Foochow, so the two localities are relatively close to each other.

ANALYSIS OF FUKIEN REPTILE FAUNA

It has been suggested in the foregoing pages that Fukien comes within several zoögeographic distributional areas. The following analysis should illustrate clearly the richness, complexity, and relative importance of its fauna.

The collections of the American Museum total seventy-seven species from Fukien. I have collected all but one of these (*Natrix helleri*). The list follows.¹

¹Marine forms are not taken into consideration here.

TURTLES

Platysternon megacephalum
Clemmys bealii
Geoclemys reevesii

Amyda tuberculata
Pelochelys cantorii

LIZARDS

Gekko japonicus
Gekko japonicus hokouensis
Gekko subpalmatus
Hemidactylus boweringii
Acanthosaura lamnidentata
Ophisaurus harti
Apeltonotus sylvaticus
Takydromus septentrionalis

Takydromus septentrionalis meridionalis
Sphenomorphus boulengeri
Sphenomorphus formosensis
Sphenomorphus indicus
Lygosaurus sowerbyi
Leiopisma modestum
Eumeces chinensis
Eumeces elegans

SNAKES

Typhlops braminus
Sibynophis collaris chinensis
Natrix aquifasciata
Natrix annularis
Natrix percarinata
Natrix craspedogaster
Natrix stolata
Natrix piscator
Natrix tigrina lateralis
Natrix helleri
Pseudozenodon bambusicola
Pseudozenodon striaticaudatus
Pseudozenodon fukienensis
Pseudozenodon karlschmidti
Zaocys dhumnades montanus
Ptyas korros
Ptyas mucosus
Tapinophis latouchi
Opisthotropis kuatunensis
Trirhinopholis styani
Dinodon futsingensis
Dinodon ruhstrati
Dinodon rufozonatum williamsi
Dinodon flavozonatum
Achalinus spinalis
Elaphe carinata
Elaphe kreyenbergi
Elaphe mandarina

Elaphe porphyracea porphyracea
Elaphe tæniura yunnanensis
Gonyosoma melli
Liopellis major
Macropisthodon rudis
Holarchus chinensis
Holarchus violaceus
Holarchus formosensis
Holarchus musyi
Holarchus (sp.?)
Calamaria septentrionalis
Enhydrys plumbea
Enhydrys chinensis
Boiga sinensis
Boiga multimaculata
Amblycephalus kuangtungensis
Amblycephalus stanleyi
Psammodynastes pulverulentus
Calliophis maccllellandii
Hemibungarus kelloggi
Bungarus multicinctus
Naja hannah
Naja naja atra
Agkistrodon acutus
Trimeresurus monticola
Trimeresurus mucrosquamatus
Trimeresurus gramineus gramineus
Trimeresurus gramineus stejnegeri

With the following addition of eight species recorded from Fukien, but not found in the American Museum collection from there, the list of Fukien reptiles is completed.

TURTLES

Ocadia sinensis (Stanley, 1914; Stejneger, 1925)

SNAKES

Python bivittatus (Stanley, 1914)

Opisthotropis maxwelli (Boulenger, 1914)

Elaphe climacophora (Stanley, 1914)

Holarchus cyclurus (Stanley, 1914)

Holarchus vaillanti (Stanley, 1914; Roux, 1919)

Coronella bella (Stanley, 1914, 1916)

Chrysopelea ornata (Stanley, 1914)

Stanley's records, especially for *Coronella bella* and *Elaphe climacophora*, require confirmation. The python, however, is well known in Fukien (see *Python bivittatus*, p. 388).

From the foregoing it is evident that definite records for some eighty-five species of reptiles inhabiting Fukien exist. Subsequent collecting will certainly increase that number and a more careful study of the present literature might even add a few.

Twenty-two species cannot well be included in a general consideration of distribution because they are known from too few localities. These are:

LIZARDS

Gekko japonicus hokouensis

Apeltonotus sylvaticus

Sphenomorphus boulengeri

Sphenomorphus formosensis

Lygosaurus sowerbyi

Leiolopisma modestum

SNAKES

Pseudozenodon striaticaudatus

Pseudozenodon fukienensis

Pseudozenodon karlschmidt

Opisthotropis kuatunensis

Opisthotropis maxwelli

Elaphe climacophora

Dinodon futsingensis

Dinodon flavozonatum

Holarchus musyi

Holarchus vaillanti

Holarchus (species?)

Chrysopelea ornata

Boiga sinensis

Coronella bella

Amblycephalus stanleyi

Hemibungarus kelloggi

This reduces the eighty-five to sixty-three. Three of the sixty-three do not prove helpful. One of them, *Amyda tuberculata*, has baffled all attempts at definite classification because it has doubtless been carried about all over China by man. It may be left out of the discussion. *Gekko japonicus*, widely distributed in the East, probably has also been spread by boats and will not shed valuable light on the problem at hand. *Geoclemys reevesii*, also found both in the north and south of eastern China, as well as in southern Japan, can hardly be considered helpful.

The remaining sixty forms when analyzed lead us to interesting conclusions. These conclusions are arrived at directly through a study of the following tables.

I.—FUKIEN FORMS OF KNOWN RANGE LISTED ACCORDING TO
LATITUDINAL DISTRIBUTION

(*Amyda tuberculata*, *Geoclemys reevesii*, *Gekko japonicus*, *Natrix tigrina lateralis* excepted)

| SOUTHERN CHINESE FORMS | CENTRAL CHINESE FORMS | FORMS FROM BOTH SOUTHERN AND CENTRAL CHINA |
|--|---|--|
| <i>Platysternon megacephalum</i> | | |
| <i>Ocadia sinensis</i> | | |
| <i>Clemmys bealii</i> | | |
| <i>Pelochelys cantorii</i> | | |
| | <i>Gekko subpalmatus</i> | |
| <i>Hemidactylus bowringii</i> | | |
| <i>Acanthosaura lamnidentata</i> | | |
| <i>Takydromus seolineatus</i> <i>meridionalis</i> | | <i>Ophisaurus harti</i> <i>Takydromus septentrionalis</i> <i>Sphenomorphus indicus</i> <i>Eumeces chinensis</i> <i>Eumeces elegans</i> |
| <i>Typhlops braminus</i> | | |
| <i>Python bivittatus</i> | | |
| <i>Natrix equifasciata</i> | | <i>Sibynophis collaris chinensis</i> <i>Natrix annularis</i> <i>Natrix percarinata</i> |
| <i>Natrix stolata</i> | <i>Natrix craspedogaster</i> | |
| <i>Natrix piscator</i> | | |
| <i>Natrix helleri</i> | | |
| <i>Pseudoxenodon bambusicola</i> | | |
| <i>Ptyas korros</i> | <i>Zaocys dhumnades</i> <i>montanus</i> | |
| <i>Ptyas mucosus</i> | | |
| <i>Tapinophis latouchi</i> | <i>Trirhinopholis styani</i> <i>Dinodon ruhrstrati</i> <i>Dinodon rufozonatum</i> <i>williamsi</i> <i>Achalinus spinalis</i> <i>Elaphe carinata</i> <i>Elaphe mandarina</i> | <i>Elaphe kreyenbergi</i> |
| <i>Elaphe porphyracea por-</i> <i>phyracea</i> | | |

| SOUTHERN CHINESE FORMS | CENTRAL CHINESE FORMS | FORMS FROM BOTH SOUTHERN AND CENTRAL CHINA |
|---|-----------------------------|--|
| | | <i>Elaphe tæniura yunnanensis</i> <i>Gonyosoma melli</i> <i>Liopeltis major</i> <i>Holarchus chinensis</i> |
| <i>Holarchus cyclurus</i> <i>Holarchus violaceus</i> <i>Holarchus formosensis</i> <i>Enhydris plumbea</i> <i>Boiga multimaculata</i> <i>Psammodynastes pulverulentus</i> | <i>Macropisthodon rudis</i> | |
| <i>Naja hannah</i> | | <i>Calamaria septentrionalis</i> <i>Enhydris chinensis</i> <i>Amblycephalus kuangtungensis</i> <i>Calliophis macclelandii</i> <i>Bungarus multicinctus</i> <i>Naja naja atra</i> <i>Trimeresurus monticola</i> <i>Trimeresurus mucrosquamatus</i> <i>Trimeresurus gramineus stejnegeri</i> |

Natrix tigrina lateralis is the one species that reaches Fukien from the north. Its southern limit is in the Ch'ungan highlands.

II.—FUKIEN FORMS OF KNOWN RANGE LISTED ACCORDING TO LONGITUDINAL DISTRIBUTION, INCLUDING ALL FORMS COMMON TO FUKIEN AND FORMOSA

(*Amyda tuberculata*, *Geoclemys reevesii*, *Gekko japonicus*, *Natrix tigrina lateralis* excepted)

| FORMS KNOWN FROM FORMOSA | FUTSING FORMS NOT FOUND IN FORMOSA AND WEST | FORMS KNOWN FROM SZE- CHWAN AND YUNNAN, AND LOCALITIES AS FAR WEST AS THESE PROVINCES ¹ |
|---|---|--|
| | <i>Platysternon megacephalum</i> <i>Ocadia sinensis</i> <i>Clemmys bealii</i> <i>Pelochelys cantorii</i> | |
| <i>Hemidactylus bowringii</i> <i>Ophisaurus harti</i> <i>Takydromus septentrionalis</i> | <i>Ophisaurus harti</i> | <i>Hemidactylus bowringii</i> <i>Acanthosaura lamnidentata</i> <i>Takydromus septentrionalis</i> <i>Takydromus sexlineatus meridionalis</i> |
| <i>Sphenomorphus boulengeri</i> | | |

¹This, of course, refers to localities in western China or those reasonably near the southern or western border, and occasionally the "Eastern Himalayas."

| FORMS KNOWN FROM FORMOSA | FUTSING FORMS NOT FOUND IN FORMOSA AND WEST | FORMS KNOWN FROM SZE- CHWAN AND YUNNAN, AND LOCALITIES AS FAR WEST AS THESE PROVINCES ¹ |
|--------------------------------------|---|---|
| <i>Sphenomorphus formosensis</i> | | |
| <i>Sphenomorphus indicus</i> | | <i>Sphenomorphus indicus</i> |
| | <i>Lygosaurus sowerbyi</i> | |
| <i>Eumeces chinensis</i> | | <i>Eumeces chinensis</i> |
| <i>Eumeces elegans</i> | | <i>Eumeces elegans</i> |
| <i>Typhlops braminus</i> | | |
| | | <i>Python bivittatus</i> |
| <i>Sibynophis collaris chinensis</i> | | <i>Sibynophis collaris chinensis</i> |
| | <i>Natrix æquifasciata</i> | |
| <i>Natrix annularis</i> | | <i>Natrix annularis</i> |
| | | <i>Natrix percarinata</i> |
| <i>Natrix stolata</i> | | <i>Natrix stolata</i> |
| <i>Natrix piscator</i> | | <i>Natrix piscator</i> |
| | | <i>Natrix helleri</i> |
| | <i>Pseudozenodon bambusicola</i> | |
| <i>Ptyas korros</i> | | <i>Ptyas korros</i> |
| <i>Ptyas mucosus</i> | | <i>Ptyas mucosus</i> |
| | | <i>Tapinophis latouchi</i> |
| | | <i>Trirhinopholis styani</i> |
| <i>Dinodon ruhrstrati</i> | | |
| <i>Dinodon rufozonatum</i> (?) | | |
| | | <i>Achalinus spinalis</i> |
| <i>Elaphe carinata</i> | | <i>Elaphe carinata</i> |
| | | <i>Elape kreyenbergi</i> |
| | | <i>Elaphe mandarina</i> |
| | | <i>Elaphe porphyracea</i> |
| | | <i>porphyracea</i> |
| <i>Elaphe tenuis yunnanensis</i> | | <i>Elaphe tenuis yunnanensis</i> |
| <i>Liopeltis major</i> | | <i>Liopeltis major</i> |
| <i>Macropisthodon rudis</i> | | <i>Macropisthodon rudis</i> |
| | | <i>Holarchus chinensis</i> |
| | | <i>Holarchus violaceus</i> |
| <i>Holarchus formosanus</i> | | |
| <i>Enhydris plumbea</i> | | <i>Enhydris plumbea</i> |
| | | <i>Enhydris chinensis</i> |
| | <i>Boiga multimaculata</i> | |
| <i>Psammodynastes pulverulentus</i> | | <i>Psammodynastes pulverulentus</i> |
| <i>Calliophis macdellandii</i> | | <i>Calliophis macdellandii</i> |
| <i>Bungarus multicinctus</i> | | <i>Bungarus multicinctus</i> |

¹That, of course, refers to localities in western China or those reasonably near the southern or western border, and occasionally the "Eastern Himalayas."

FORMS KNOWN FROM
FORMOSA

Naja naja atra
Agkistrodon acutus
Trimeresurus monticola
Trimeresurus mucrosquamatus
Trimeresurus gramineus
gramineus
Trimeresurus gramineus stejnegeri

FORMS KNOWN FROM SZE-
CHWAN AND YUNNAN, AND
LOCALITIES AS FAR WEST AS
THESE PROVINCES¹

Naja hannah
Agkistrodon acutus
Trimeresurus monticola
Trimeresurus mucrosquamatus
Trimeresurus gramineus
gramineus
Trimeresurus gramineus stejnegeri

III.—DISTRIBUTION OF FORMS WITHIN FUKIEN²FUTSING HSIEN AND
FOOCHOW

YENPING REGION

CH'UNGAN HSIEN, HOK'OU,
AND CH'IENTSHAN HSIEN

TURTLES

Platysternon megacephalum
[Ocadia sinensis]
Clemmys bealii
Geoclemys reevesii
Amyda tuberculata
Pelochelys cantorii

Amyda tuberculata

Geoclemys reevesii
Amyda tuberculata

LIZARDS

(*Gekko janonicus*)

*[Gekko subpalmatus]*³
Hemidactylus bowringii
[Ophisaurus harti]

Gekko subpalmatus
Hemidactylus bowringii
Acanthosaura lamnidentata

Gekko japonicus hokouensis
Gekko subpalmatus
Acanthosaura lamnidentata
Ophisaurus harti
Apellonotus sylvaticus?

Takydromus septentrionalis
Takydromus sexlineatus meridionalis

Takydromus septentrionalis
[Takydromus sexlineatus meridionalis]
Sphenomorphus boulengeri

Takydromus septentrionalis
Takydromus sexlineatus meridionalis
Sphenomorphus boulengeri
Sphenomorphus formosensis

Sphenomorphus indicus
Lygosaurus sowerbyi

Sphenomorphus indicus

Leiopisma modestum

Leiopisma modestum

¹This, of course, refers to localities in western China or those reasonably near the southern or western border, and occasionally the "Eastern Himalayas."

²Those enclosed in parentheses are not in the present collection, while the bracketed forms are not represented in the American Museum collection.

³The "Foochow" record of these mountain species I doubt. The specimens were probably brought to Foochow from the mountains of the interior.

| FUTSING HSIEN AND FOOCHOW | YENPING REGION | CH'UNGAN HSIEN, HOK'OU, AND CH'IENTSHAN HSIEN |
|---|---------------------------------------|--|
| | LIZARDS (Continued) | |
| <i>Eumeces chinensis</i> | <i>Eumeces chinensis</i> | <i>Eumeces chinensis</i> |
| | <i>Eumeces elegans</i> | <i>Eumeces elegans</i> |
| | SNAKES | |
| <i>Typhlops braminus</i> | (<i>Typhlops braminus</i>) | |
| | [<i>Python bivittatus</i>] | |
| <i>Sibynophis collaris chinensis</i> | <i>Sibynophis collaris chinensis</i> | <i>Sibynophis collaris chinensis</i> |
| <i>Natrix æquifasciata</i> | <i>Natrix æquifasciata</i> | |
| <i>Natrix annularis</i> | <i>Natrix annularis</i> | <i>Natrix annularis</i> |
| <i>Natrix percarinata</i> | <i>Natrix percarinata</i> | <i>Natrix percarinata</i> |
| | <i>Natrix craspedogaster</i> | <i>Natrix craspedogaster</i> |
| <i>Natrix stolata</i> | <i>Natrix stolata</i> | <i>Natrix stolata</i> |
| <i>Natrix piscator</i> | <i>Natrix piscator</i> | <i>Natrix piscator</i> |
| | (<i>Natrix helleri</i>) | <i>Natrix trigrina lateralis</i> |
| <i>Pseudozenodon bambusicola</i> | <i>Pseudozenodon bambusicola</i> | |
| | | <i>Pseudozenodon striaticaudatus</i> |
| | | <i>Pseudozenodon fukienensis</i> |
| | | <i>Pseudozenodon karlschmidti</i> |
| | <i>Zaoecys dhumnades montanus</i> | <i>Zaoecys dhumnades montanus</i> |
| <i>Ptyas korros</i> | <i>Ptyas korros</i> | <i>Ptyas korros</i> |
| <i>Ptyas mucosus</i> | <i>Ptyas mucosus</i> | <i>Ptyas mucosus</i> |
| <i>Tapinophis latouchi</i> | <i>Tapinophis latouchi</i> | <i>Tapinophis latouchi</i> |
| | | <i>Opisthotropis kuatunensis?</i> |
| [<i>Trirhinopholis styani</i>] ¹ | | <i>Trirhinopholis styani</i> |
| <i>Dinodon futsingensis?</i> | | <i>Dinodon ruhstrati</i> |
| | <i>Dinodon rufozonatum williamsi</i> | <i>Dinodon rufozonatum williamsi</i> |
| | | <i>Dinodon flavozonatum</i> |
| <i>Elaphe carinata</i> | | <i>Achalinus spinalis</i> |
| | | <i>Elaphe carinata</i> |
| | | <i>Elaphe kreyenbergi</i> |
| | | <i>Elaphe mandarina</i> |
| <i>Elaphe porphyracea porphyracea</i> | <i>Elaphe porphyracea porphyracea</i> | <i>Elaphe porphyracea porphyracea</i> |
| | | <i>Elaphe tæniura yunnanensis</i> |
| <i>Liopeltis major</i> | <i>Gonyosoma melli</i> | <i>Gonyosoma melli</i> |
| [<i>Macropisthodon rudis</i>] ¹ | <i>Liopeltis major</i> | <i>Liopeltis major</i> |
| | | <i>Macropisthodon rudis</i> |
| | <i>Holarchus chinensis</i> | <i>Holarchus chinensis</i> |
| <i>Holarchus violaceus</i> | (<i>Holarchus violaceus</i>) | |
| <i>Holarchus formosanus</i> | <i>Holarchus formosanus</i> | <i>Holarchus formosanus</i> |

¹The "Foochow" record of these mountain species I doubt. The specimens were probably brought to Foochow from the mountains of the interior.

| FUTSING HSIEN AND FOOCHOW | YENPING REGION | CH'UNGAN HSIEN, HOK'OU, AND CH'IENTSHAN HSIEN |
|---|--|--|
| | SNAKES (Continued) | |
| | | <i>Holarchus musyi</i> |
| | | <i>Holarchus</i> (sp.?) |
| [<i>Calamaria septentrionalis</i>] ¹ | <i>Calamaria septentrionalis</i> | <i>Calamaria septentrionalis</i> |
| <i>Enhydris plumbea</i> | <i>Enhydris plumbea</i> | <i>Enhydris plumbea</i> |
| <i>Enhydris chinensis</i> | <i>Enhydris chinensis</i> | <i>Enhydris chinensis</i> |
| <i>Boiga sinensis</i> | | <i>Boiga sinensis</i> ? |
| <i>Boiga multimaculata</i> | | |
| | | <i>Amblycephalus kuangtungensis</i> |
| | | <i>Amblycephalus stanleyi</i> ? |
| <i>Psammodynastes pulverulentus</i> | <i>Psammodynastes pulverulentus</i> | |
| | | <i>Calliophis maclellandii</i> |
| | | <i>Hemibungarus kelloggi</i> |
| <i>Bungarus multicinctus</i> | <i>Bungarus multicinctus</i> | <i>Bungarus multicinctus</i> |
| <i>Naja hannah</i> | | |
| <i>Naja naja atra</i> | <i>Naja naja atra</i> | <i>Naja naja atra</i> |
| | | <i>Agkistrodon acutus</i> |
| | | <i>Trimeresurus monticola</i> |
| <i>Trimeresurus mucro-squamatus</i> | <i>Trimeresurus mucro-squamatus</i> | |
| <i>Trimeresurus gramineus gramineus</i> | <i>Trimeresurus gramineus gramineus</i> | <i>Trimeresurus gramineus gramineus</i> |
| <i>Trimeresurus gramineus stejnegeri</i> | <i>Trimeresurus gramineus stejnegeri</i> | <i>Trimeresurus gramineus stejnegeri</i> |

From a study of the preceding data I am able to make the following table. The first division shows the percentage of forms that, when grouped according to general relative distribution, comprise the total fauna of the three important Fukien regions, the second the percentage of each group found in each region.

I

| | Percentage Comprising Futsing and Foochow Fauna | Percentage Comprising Yenping Fauna | Percentage Comprising Ch'ungan Hsien Fauna |
|---|---|--|---|
| Southern China forms | 50 | 43 | 22 |
| Central China Forms | 2 | 10 | 22 |
| Forms found in both southern and Central China | 36 | 41 | 51 |

¹The "Foochow" record of these mountain species I doubt. The specimens were probably brought to Foochow from the mountains of the interior.

II

| | Percentage of Total Found in Foochow and Futsing Hsien Region | Percentage of Total Found in Yenping Region | Percentage of Total Found in Ch'ungan Hsien Region |
|---|--|---|---|
| Southern China forms (25 in number) | 88 | 72 | 40 |
| Central China forms (11 in number) | 9 | 36 | 100 |
| Forms found in both Southern and Central China (23 in number) | 91 | 74 | 61 |

Before discussing and drawing conclusions it will be well to emphasize through repetition the relationship of the three localities whose faunas are under discussion, the Futsing-Foochow region, the country surrounding Yenping, and the Ch'ungan Hsien district. All three localities have mountains as well as more or less level sections. Futsing and Foochow are about half a degree south of Yenping and one and a half south of Ch'ungan Hsien. Measured on a map, Foochow is only 80 miles from Yenping and some 150 from Ch'ungan Hsien. By road the distance is of course very much greater.

1. RICHNESS OF FUKIEN FAUNA.—More than sixty species of snakes are known to occur in Fukien. This alone is a long list for such a small area. Sixteen turtles may be taken as a good number of species too. The Ch'ungan Hsien region is not rich in turtles and, in fact, the mountains of its western section seem to be devoid of them entirely.

2. FAUNAL RELATIONSHIPS.—This is an involved subject and can not be easily exhausted.

(a) Futsing Hsien and Foochow Region.—Eighty-eight per cent of the twenty-five Fukien forms classed as "Southern" are found here. Seven of these are not found in Formosa, Ch'ungan Hsien, nor western China. This group of seven are southern forms that find their northern limit here. That the Futsing-Foochow fauna is closely related to the Formosan is shown by the fact that twenty-one of the thirty-three forms common to Formosa and Fukien comprise a part of its fauna. "Central" Chinese forms comprise only two per cent of the Futsing-Fukien fauna. More than half of the twenty-two forms common to the Ch'ungan and Futsing-Foochow regions are widely distributed, open country reptiles while only nine of those found in the Ch'ungan mountains occur in Futsing and about Foochow.

Thus we see that the Futsing-Foochow fauna is composed primarily of "southern" Chinese forms and secondarily of forms widely distributed through central and

southern China, some of which have ranges still greater. Several tropical forms find their northern limit here.

(b) Yenping Region.—On account of its intermediate position, and the great range in altitude found within its limits, this region is not readily analyzed in regard to faunal distribution. The wide valley of the Min allows many southern forms to enter, while the high mountains west of the city approximate the conditions found in Ch'ungan Hsien. The Yenping fauna is made up of almost equal parts of "southern" forms and forms found in both central and southern China. Those classed as exclusively "central" comprise only ten per cent of the Yenping list.

(c) Ch'ungan Hsien Region.—In spite of the absence of turtles no less than sixty-two forms of reptiles are known from this region.

All of the eleven classed as "central" Chinese forms, sixty-one per cent of the twenty-three found in both southern and central China, but only forty per cent of the twenty-five "southern" forms occur here. Twenty-seven of the thirty-three Fukien forms known from Formosa have been taken in this region, or six more than the number from the Futsing-Foochow region.

It has long been known that many species found in the eastern Himalayas and the mountains of western China occur in the Formosan highlands. The Ch'ungan Hsien mountains are now known to harbor a great many western forms just as those of Formosa do. Among the mountain inhabiting forms found both in Fukien and the far west only nine occur in the Futsing mountains, while just twice as many are found in those of Ch'ungan Hsien. One form, *Natrix tigrina lateralis*, reaches Ch'ungan Hsien from the north.

The rich Ch'ungan Hsien fauna, then, includes the entire central Chinese fauna and is extremely rich in forms found in both central and southern China. Many mountain forms common in the eastern Himalayas and the higher ranges of western China extend across through the Ch'ungan mountains and to the highlands of central Formosa. The remainder of the fauna is made up of open country species whose ranges are very extensive in southeastern Asia.

Conclusions Drawn from Analysis of Fukien Fauna

1. The reptile fauna of Fukien contains in good measure all the faunal elements abundant in China, with the exception of the desert and semi-desert forms comprising the fauna of the Mongolian region.

2. This rich Fukien reptile fauna is made up of the following elements:

(a) Forms common in Central China:—occurring on the plateau and mountains of the western section of the Province.

(b) Tropical and semi-tropical forms:—found on the coastal plains at least as far north as Foochow and abundant on the low plains of the southeastern part of the Province.

(c) Widely distributed reptiles common over large areas of southern China and even southeastern Asia. These are widely distributed through the Province.

3. The reptile fauna of Fukien is closely related to that of Formosa as shown by the following:

(a) the marked similarity between forms inhabiting the plains and plateaus of both places, and,

(b) the striking resemblance of forms found in their highest ranges but absent in much intervening mountainous country.

HABITAT PREFERENCE

The behavior and habitat relationships of snakes have received comparatively little attention. These are, however, not only interesting from the point of view of the nature lover but, when properly recorded, may help in distributional, taxonomic and phylogenetic problems. While collecting I always made as many notes as possible on all the species that came under observation. Following the description of each form many detailed observations have been set down and, in order to bring these data together, I have made out a table. This table is of a general nature and not to be taken as final but only as a suggestion of the habitats preferred by the various species. There doubtless are errors. Starred forms are found in more than one column. Whenever there is doubt I have put a question mark.

AQUATIC FORMS

| Running Water | | Quiet Water | |
|-----------------------------------|---|-----------------------------|--|
| Mountain Streams | Hill and Plain Streams | Muddy Pools | Flooded Fields |
| * <i>Natrix percarinata</i> | <i>Natrix aquifasciata</i> | * <i>Enhydria plumbea</i> | * <i>Natrix annularis</i> |
| <i>Tapinophis lutouchi</i> | * <i>Natrix annularis</i> | * <i>Enhydria chinensis</i> | * <i>Natrix percarinata</i> |
| <i>Opisthotrophis kualunensis</i> | * <i>Natrix tigrina lateralis</i> (in North China) | | <i>Natrix piscator</i> |
| | | | * <i>Natrix tigrina lateralis</i> (in Central and North China) |
| | | | <i>Elaphe rufodorsata</i> |
| | | | * <i>Enhydria plumbea</i> |
| | | | * <i>Enhydria chinensis</i> |

TERRESTRIAL FORMS

| Mountain Forests | Open, Level, and Hilly Regions | Burrowing |
|---|--|--------------------------|
| <i>Sibynophis collaris chinensis</i> | <i>Natrix stolata</i> | |
| <i>Natrix craspedogaster</i> | * <i>Pseudozenodon bambusicola</i> | <i>Typhlops braminus</i> |
| * <i>Natrix tigrina lateralis</i> (in Fukien) | <i>Zaocys dhumnades dhumnades</i> | <i>Achalina spinalis</i> |
| | <i>Coluber spinalis</i> | |
| * <i>Pseudozenodon bambusicola</i> ? | <i>Ptyas korros</i> | |
| <i>Pseudozenodon striaticaudatus</i> | <i>Ptyas mucosus</i> | |
| <i>Pseudozenodon fukienensis</i> | <i>Dinodon rufozonatum rufozonatum</i> | |
| <i>Pseudozenodon karlschmidti</i> | <i>Elaphe schrencki</i> ? | |
| <i>Zaocys dhumnades montanus</i> | <i>Elaphe carinata</i> | |
| <i>Trirhinopholis styani</i> | <i>Elaphe dione</i> | |
| <i>Dinodon futsingensis</i> ? | <i>Holarchus chinensis</i> | |

| Mountain Forests | Open, Level, and Hilly Regions |
|--|---------------------------------------|
| <i>Dinodon ruhrati</i> | <i>Holarchus violaceus</i> |
| <i>Dinodon rufozonatum</i> | <i>Holarchus formosanus</i> |
| <i>williamsi</i> | <i>Calliophis septentrionalis</i> |
| <i>Dinodon flavozonatum</i> | * <i>Boiga multimaculata</i> |
| <i>Elaphe carinata</i> | * <i>Psammodynastes pulverulentus</i> |
| <i>Elaphe kreyenbergi</i> | <i>Bungarus multicinctus</i> |
| <i>Elaphe mandarina</i> | <i>Naja naja atra</i> |
| <i>Elaphe porphyracea</i> | * <i>Trimeresurus mucrosquamatus</i> |
| <i>porphyracea</i> | * <i>Trimeresurus gramineus</i> |
| * <i>Elaphe tæniura yunnanensis</i> | <i>gramineus</i> |
| * <i>Gonyosoma melli</i> | |
| <i>Macropisthodon rudis</i> | |
| <i>Holarchus musyi</i> | |
| * <i>Boiga sinensis</i> | |
| * <i>Psammodynastes pulverulentus</i> | |
| <i>Amblycephalus kuangtungensis</i> | |
| <i>Amblycephalus stanleyi</i> | |
| <i>Calliophis maclellandii</i> | |
| <i>Hemibungarus kelloggi</i> | |
| <i>Agkistrodon acutus</i> | |
| <i>Trimeresurus monticola</i> | |
| * <i>Trimeresurus mucrosquamatus</i> | |
| * <i>Trimeresurus gramineus stejnegeri</i> | |

ARBOREAL FORMS

- **Elaphe tæniura yunnanensis*
- **Gonyosoma melli*
- **Boiga sinensis*
- **Boiga multimaculata*
- **Trimeresurus gramineus gramineus*
- **Trimeresurus gramineus stejnegeri*

FOOD PREFERENCE

The stomachs of nearly all of the specimens treated in this paper have been examined and the resulting data supplemented by my field observations and data secured by Schmidt through a study of the stomach contents of the collection of Hainan snakes included in his 'Reptiles of Hainan.'

Species of the genus *Natrix* inhabit, for the most part, watercourses, flooded fields, and grass-grown moist or swampy areas. Their food consists in every case but one, at least, partly of frogs, and certainly that one, *N. æquifasciata*, will be found to eat frogs when more stomachs are examined. Fish, the only other element of their diet (excepting a single crayfish eaten by *N. percarinata*), were also found in the stomachs

of *annularis*, *percarinata*, and *piscator*, three exceptionally aquatic species. The single semiaquatic *Elaphe* (*rufodorsata*) eats both fishes and frogs, but three dry land forms do not include either amphibians or fishes in their diet, two of them, *mandarina* and *porphyracea porphyracea* living on mammals, the third, *carinata*, apparently specializing on snakes. This is our first indication of a highly specialized food habit. Contrasted to this is *Dinodon rufozonatum* (and form), adapted to a semi-aquatic as well as a completely terrestrial life that has extended its diet to include fishes, frogs, toads, lizards and even other snakes. This snake-eating tendency shows itself in another *Dinodon* species, *flavozonatum*, which, together with its congener *ruhstrati*, decidedly prefers to subsist on skinks and *Takydromus* species. With the exception of *gramineus* and *stejnegeri* the pit-vipers of the genus *Trimeresurus* consume birds and mammals, but at Kuatun *stejnegeri* is very fond of mountain streams where breeding frogs abound, and on more than one occasion I found good evidence of its fondness for frogs as food. *Agkistrodon acutus*, another pit-viper, eats rats as well as birds. *Boiga sinensis* and *multi-maculata* seem to prefer birds, but one of the former was found to have taken a lizard.

From the foregoing it is evident that snakes show decided food preferences but vary greatly as to catholicity of appetite. It would be interesting to see just how fixed these preferences are, i.e., how easily they could be eliminated. This would require elaborate experimentation, but the fact that closely related forms often adopt very divergent habits indicates that the preferences are not rigid but come about largely through fortuity.

On the other hand, cases of apparent rigid specialization, comparable to that of *E. carinata*, are not of rare occurrence. The most striking ones follow:

1.—*Enhydryis chinensis* and *plumbea* are exceedingly closely related but exceptionally stable species that frequent flooded fields where both frogs and fish abound. The former, however, lives on a fish, the latter a frog diet. This was true of both the Hainan and Fukien-Kiangsi series and thus their physical stability is reflected in their food habits. Preference for a fish diet probably indicates a more aquatic origin and further field observations should be made in widely separated parts of their ranges.

2.—*Liopeltis major*, in spite of its large size and diurnal habits, confines its diet to earthworms. It is neither a burrowing nor secretive form. This same habit in *Tapinophis latouchi*, a nocturnal, burrowing,

mountain-stream inhabitant, is more understandable and quite as fixed. *Trirhinopholis styani*, closely related to *latouchi*, seems to have similar food habits and it would be interesting to know whether or not the third member of this group, *Opisthotropis kuatunensis*, eats the same.

The data on which the foregoing is based are all too meagre and further study will certainly prove some of the conclusions to be premature.

No information was secured on the food habits of fourteen genera as follows: *Typhlops*, *Zaocys*, *Coluber*, *Opisthotropis*, *Lycodon*, *Achalinus*, *Gonyosoma*, *Holarchus*, *Calliophis*, *Amblycephalus*, *Calamaria*, *Hemibungarus*, *Bungarus*, and *Hydrophis*, while that secured on *Python* and *Pseudoxenodon* was too little to be of much value.

BREEDING HABITS

SEASON.—Data secured on six species of lizards from northwestern Fukien Province, *Acanthosaura lamnidentata*, *Ophisaurus harti*, *Apeltonotus sylvaticus*, *Takydromus septentrionalis*, *Leiolopisma modestum*, and *Eumeces elegans*, indicate that there is remarkable uniformity in time of egg-laying among them. Gravid females were taken in July, while well-developed eggs and newly emerged young were abundant in August. In Hainan a specimen of *Takydromus sexlineatus meridionalis* deposited eggs on the twenty-first of April. This shows how retarded the season of the northwestern Fukien highlands is, compared to that of semitropical Hainan.

Seven among eleven species of snakes (*Natrix percarinata*, *Tapi-nophis latouchi*, *Elaphe carinata*, *Elaphe tæniura yunnanensis*, *Amblycephalus kuangtungensis* and *stanleyi*, and *Trimeresurus monticola*) closely agree with the lizards, but female *Enhydris plumbea* and *chinensis* and *Psammodynastes pulverulentus* were gravid in May. A cobra, *Naja naja atra*, from Hok'ou, taken between June 20 and July 12, held eggs in well-advanced stages. At Ningkwo in Anhwei Province a *Natrix annularis* gave birth to young, September 28.

PRODUCTIVITY.—Among the lizards, no data on any of the Gekkonidæ or any *Sphenomorphus*, *Lygosaurus* or *Mabuya* species were secured, but the data on the remainder of the lizards were almost complete. The only agamid, *Acanthosaura lamnidentata*, leads in the number of eggs produced at one time, with an average of fifteen eggs for ten females. The only anguid, *Ophisaurus harti*, averages six eggs per female and thus agrees well with the two species of skinks on which there are data, *Eumeces elegans* and *Leiolopisma modestum*. Least productive of all are the three lacertid genera in which good data for four species are at hand,

Apeltonotus sylvaticus, *Takydromus septentrionalis*, *Takydromus sexlineatus meridionalis*, and *Eremias argus*. The number of eggs with these averages three or four.

Among the colubrid snakes, *Natrix piscator* seems to be capable of producing the greatest number of young, for one female contained forty-two well-developed eggs. The average for three specimens, twenty-five, is only three greater than that for four females of *Macropisthodon rudis*, the colubrid snake with the second highest egg-producing ability. *N. piscator* is a marked exception in its genus, because counts on five other species show a range in average of five to eight for each species, with no individual exceeding nine. In fact, there is great uniformity in this respect. Four *Elaphe* species are even more uniform, the average among three, *carinata*, *rufodorsata*, and *tæniura yunnanensis*, being twelve, while the single gravid *dione* contained eleven. *E. rufodorsata* shows a strong tendency to vary, ranging from four to twenty-one in eleven specimens. The remaining data throw the rest of the species into two heterogeneous groups:

Those that average three to six young:

Sibynophis collaris chinensis
Tapinophis latouchi
Dinodon ruhstrati
Amblycephalus kuangtungensis
Calliophis maclellandii

Those that average seven to ten young—

Trirhinopholis styani
Dinodon rufozonatum williamsi
Achalinus spinalis
Liopeltis major
Amblycephalus stanleyi
Psammodynastes pulverulentus
Hemibungarus kelloggi
Naja naja atra

No counts were secured on the following colubrid genera: *Zaocys*, *Coluber*, *Ptyas*, *Lycodon*, *Gonyosoma*, *Holarchus*, *Calamaria*, *Boiga*, and *Hydrophis*, while the single one made on a *Pseudoxenodon* is scarcely worthy of mention. Much work remains to be done along this line.

Only a few pit-vipers were gravid but a large *Agkistrodon acutus* held twenty-six eggs, indicating an average much higher than that for any of the species of *Trimeresurus*. Two female *T. gramineus*, one of each form, contained four eggs apiece, while the good data secured on *T. monticola* show a count of five or six eggs to a nest. *T. mucrosquamatus*

probably exceeds these other species, three females holding five, nine, and thirteen eggs, respectively.

BROODING.—An anguid lizard, *Ophisaurus harti*, a colubrid snake, *Natrix percarinata*, and a pit-viper, *Trimeresurus monticola*, were found to possess a well-developed brooding instinct. The height of development is shown by the fact that all the brooded eggs were in advanced stages and, in the case of the snakes, especially the pit-viper, discovery did not result in desertion.

SEXUAL DIMORPHISM

Sexual differences among lizards and snakes are well known and no special study has been made of such in this paper, but certain obvious and striking cases are worth bringing together.

The most interesting examples among the lizards is the color difference in *Ophisaurus harti*; but striking as it may be it is not constant, some of the females being gaudily marked like the males. The lateral ocelli of *Takydromus sexlineatus meridionalis* are more vivid in the females. Two skinks, *Lygosaurus sowerbyi* and *Mabuya multifasciata*, have a slight difference in the coloration of the sides. Differences in size, such as the larger head of male *O. harti* and the shorter leg of female *L. sowerbyi*, are scarcely worthy of mention here.

Coming to the snakes we find more recorded differences. These are in (1) size, (2) proportion of length occupied by the tail, (3) squamation, especially of the ventrum, (4) coloration, and (5) external structure of the first pair of chin-shields and the anterior lower labials. These may best be considered separately.

1. **SIZE.**—The female of seventy-four per cent of the thirty-five species on which there is good data attain decidedly the greatest body-length. There is little sexual difference among seventeen per cent, but in the remaining nine per cent the males actually average a little longer.

2. **TAIL LENGTH.**—The males of seventy-three per cent of fifty-five species have proportionately longer tails, the difference being marked. The proportional tail-length is about equal in sixteen per cent, while in the remainder the females' tail is by a smaller margin relatively longer.

3. **SQUAMATION.**—(a) Number of Ventrals.—Good averages were secured for fifty species and in sixty-four per cent of these the females' averages noticeably exceeded those of the males. The male averages were only slightly higher in sixteen per cent, while the remainder showed no sexual difference.

(b) Number of Caudals.—Here the relation is reversed for the males markedly exceed the females in eighty-two per cent, equal them in sixteen, and fall below in only one case, or two per cent. Data on forty-five species is at hand.

4. COLORATION.—Sexual color differences are rare in Chinese snakes, only five of the present species having been found to show any: *Pseudozenodon bambusicola*, *Holarchus chinensis*, *Psammodynastes pulverulentus*, *Natrix annularis*, and *Trimeresurus gramineus stejnegeri*. In the first the difference is one of vividness of pattern, female *P. bambusicola* having a more contrasted coloration; in the next two the ground color differs, the female of *H. chinensis* being generally redder, that of *P. pulverulentus* decidedly darker than the male. There are fewer bands in the female of *N. annularis* (and possibly *N. percarinata* on which no data was taken), so here we get a different type of dimorphism. *P. bambusicola* shows indication of a similar but reversed difference, the females of my too small series averaging more than the males. The pattern of the side of the head in male *T. g. stejnegeri* generally differs slightly from that of the female.

5. STRUCTURE OF CHIN-SHIELDS AND LOWER LABIALS.—There are granules on the anterior lower labials and the first pair of chin shields in male *Natrix aequifasciata* and *percarinata*. Rarely the females of these species have similar but poorly developed granules.

Returning to the first three sexual differences the following generalization may be made. The females of Chinese snakes, especially those from the southeast, grow to be longer than the males and average more ventral plates. The males exceed in proportional tail-length and number of caudal plates. The severest test of such a rule is to see how many forms conform to it in its entirety. I find that seventeen of thirty-four forms with comparatively complete data fit the generalization, while nine additional species agree in all but the question of maximum size attained, data on this point being poor or entirely lacking.

Instead of giving complete lists I shall only record the names of the few species that are exceptional. *Pseudoxenodon striaticaudatus*, *Liopeltis major* and *Holarchus musyi* are the three species in which the males attain the greatest body-length. *Dinodon flavozonatum* might well be placed here even though data on it are few. *Elaphe taniura yunnanensis* has a tail so much longer in the female than the male that no other species can be compared to it. *Natrix percarinata*, *Ptyas mucosus* and *Boiga sinensis* agree with it but to a much less degree. Coming to the question of average number of ventrals I find four species in which there is a comparatively marked higher average count in the males: *Natrix aequifasciata* and *annularis*, *Tapinophis latouchi* and *Enhydryis chinensis*. In *Elaphe porphyracea porphyracea* alone does the caudal count of the female exceed that of the male.

A glance at the names given above shows that absolute body and proportional tail-length and the number of plates covering the ventrum considered from the point of view of sex give little clue to relationships. Only once in the preceding paragraph is a generic name repeated.

ONTOGENETIC COLOR CHANGE

The usual type of color change brought on by age among reptiles is a general fading of the most contrasted elements of the color pattern. This occurs in many banded *Natrix* species such as our *annularis* and *percarinata* and probably to a less degree in *aequifasciata*. The fading out of the ocelli on top of the head in *Clemmys bealii* may be placed here. A modification of this form is that found in *Ptyas korros* and *mucosus*, *Tapinophis latouchi* and *Opisthotropis kuatunensis* where elements of the pattern, weak even in the juveniles, disappear entirely with age.

Another common type is a partial fading accompanied by a shifting of emphasis in certain elements of the pattern and a slight change in general coloration. *Agkistrodon acutus* exhibits this kind and thus one is likely to be deceived by the appearance of the young. *Pseudoxenodon* species show a strong tendency to fade as they grow older but, in addition, at least one species exhibits an actual change in pattern. A field study alone will finally enable them to be accurately classified. *Elaphe kreyenbergi* might properly be mentioned here because of its rather marked change.

Most remarkable and interesting of all is the complete color transformation of *Ophisaurus harti*, *Eumeces elegans* and *chinensis*, and *Gonyosoma melli*. So striking is the change in each one of these that on a basis of coloration adult and young would never be placed together.

Schmidt (1927) speaks of the juvenile pattern of *Elaphe schrenckii*. I am not aware just how great the difference between adult and young is in this species. *Elaphe porphyracea porphyracea* may undergo a complete transformation of ground color but my notes on this point are confused and confirmation is needed.

ANNOTATED LIST OF SPECIES

TESTUDINATA

Platysternidæ

PLATYSTERNON

Platysternon megacephalum Gray

Six specimens, five from Amoy (Nos. 35204-208), and one from Foochow (No. 35165), represent this species. Stanley (1914 and 1918) and Stejneger (1925) have reported this turtle from Fukien.

These agree well with the seventeen Hainan specimens recorded by Schmidt (1927). Measurements in millimeters of the Foochow specimen and the largest of each sex from Amoy follow.

| A. M. N. H. No. | SEX | LENGTH CARAPACE | BREADTH CARAPACE | GREATEST DEPTH | LENGTH PLASTRON | LENGTH TAIL |
|--------------------|-----|--------------------|---------------------|-------------------|--------------------|----------------|
| 35165 | ♀ | 135 | 102 | 43 | 104 | 113 |
| 35205 | ♂ | 119 | 91 | 41 | 100 | 107 |
| 35206 | ♀ | 119 | 84 | 41 | 93 | 123 |

I failed to find any of these, but a most reliable collector reported that they were taken in mountain streams. They certainly occur in Futsing Hsien but not in the Ch'ungan region, for the mountaineers there had never seen any sort of a turtle, and did not know what to call some which we had in our lowland collection.

Testudinidæ

CLEMMYS

Clemmys bealii (Gray)

Four specimens, two from Futsing Hsien (Nos. 34198-199), and two from Foochow (Nos. 35179-180) are in the collection and constitute the first Fukien records. Schmidt (1927) gave the first Hainan record: five examples from Nodoa.

The temporal ocellæ are faded in all the Fukien specimens though the pattern is perfectly distinct. This was the case in the largest Hainan specimen.

The measurements of this series are as follows:

| A. M. N. H. No. | SEX | LENGTH CARAPACE | BREADTH CARAPACE | DEPTH | LENGTH PLASTRON | LENGTH TAIL |
|--------------------|-----|--------------------|---------------------|-------|--------------------|----------------|
| 34198 | ♂ | 141 | 96 | 47 | 120 | 31 |
| 34199 | ♂ | 129 | 89 | 47 | 111 | 28 |
| 35179 | ♂ | 131 | 92 | 48 | 112 | 29 |
| 35180 | ♀ | 138 | 95 | 47 | 113 | 35 |

GEOCLEMMYS

Geoclemys reevesii (Gray)

Forty-five specimens, seven from Tsinan, Shantung Province (Nos. 29629-635), twenty-eight from Futsing Hsien (Nos. 34193-197, 34200-211, and 34219-229), four from Foochow (Nos. 35181-184), and six from Hok'ou (35117-122), represent this species.

Schmidt's 1927 report included thirty-five from Hunan and Anhwei Provinces.

The melanistic phase is represented by two Futsing examples and one from Hok'ou. The largest specimen, also from Futsing, has a carapace 213 mm. long.

Geoclemys grangeri Schmidt

A single specimen (No. 35239) from the type locality, Yenchingkao, Wanh sien, Szechwan, also collected by Walter Granger, is in the present collection.

This specimen agrees with the type in coloration and in the smaller occipital shields of the skin, but the character chiefly relied upon, the larger size of the axillary shield and its broad contact with the fifth marginal, is not borne out by it. However, this second example has extremely long gular shields which nearly separate the humerals.

G. grangeri at best will prove to be little more than a subspecies. Further material must be secured before its position can be definitely settled.

Trionychidæ**AMYDA****Amyda tuberculata** (Cantor)

Eighty specimens, twenty-one from Futsing Hsien (Nos. 34212-218 and 34230-243), eleven from Foochow (Nos. 35168-178), one from Yenching (35164), four from Kienning (Nos. 35134-137), three from Kienyang (Nos. 35131-133), six from Ch'ungan Hsien (Nos. 35045-050), eight from Hok'ou (Nos. 35123-130), fourteen from Tsinan (Nos. 29636-649), one from Peking (No. 29369), and eleven from the Western Hills near Peking (Nos. 29618-628), probably represent this species.

Schmidt discusses the status of these turtles at length in his 1927 report and it is not necessary to repeat. More widespread material must be awaited.

PELOCHELYS**Pelochelys cantorii** Gray

Two specimens, both from Foochow (Nos. 35166-167), represent this species.

These small examples constitute the first Fukien record. Schmidt (1927) had the first two ever reported from Hainan. He figures the skull and hyoid.

SAURIA**Gekkonidæ****GEKKO**

Figure 1

Gekko japonicus hokouensis, new subspecies

TYPE.—A. M. N. H. No. 35090; ♂; Hok'ou, northeast Kiangsi Province, China; June 28-July 12, 1926; Clifford H. Pope.

DIAGNOSIS.—Differs from typical *japonicus* chiefly in having a large, undivided tubercular scale on each side of the base of the tail.

DESCRIPTION OF TYPE.—Head moderately large; snout longer than distance between eye and ear-opening, about twice diameter of eye; ear-opening suboval, oblique. Digits moderately expanded with slight but distinct rudiments of web; the single pair of chin-shields longer than broad, bordered in front and on the sides by mental, 2 lower labials, and 2 shields each half as large as the chin-shields; bordered behind by 4 small subequal shields. The back and limbs are covered with small, granular scales intermixed with numerous, small, subconical tubercles which are larger and more numerous along the upper sides than down the center of the back; preanal pores 6; single tubercular scale on each side of base of tail three-fourths as long as diameter of eye. Length from snout to vent 56 mm., from vent to end of tail (which has a bit of end missing) 65 mm.

The color is grayish brown with 5 very indistinct, slightly darker cross-bands on the back and 9 rather distinct ones across the tail.

DESCRIPTION OF PARATYPES.—There are fourteen paratypes, thirteen from the type locality (Nos. 35087-089 and 35091-100), and one from Ch'ungan Hsien City (No. 33491). All of these were taken on a plateau, Hok'ou being at the western base of the dividing range, Ch'ungan Hsien City near the eastern.

Numerous tubercles are present on the dorsum and the webbing is rudimentary in all. There are 6 preanal pores in all of the seven males, except one which has 7; the shields of the single pair of chin-shields are large and undivided in all but two, divided on only one side in these two. The three largest males measure from snout to vent 63.5, 60, and 60 mm., the three largest females 66, 65, and 62, respectively. The tail occupies from 0.49 to 0.54 of the total length. The tubercular scales at the base of the tail are largest in the males and single everywhere except on one side in No. 35097 where there are 2. On one side in two and both sides

in one there is a depression across the top of the tubercular scale. The body-bands are often obscure but, when visible, they number 5 in all but one which has 6. The tail, when fully banded, has from 8 to 10 bands.

I have re-examined twenty-three of the series of thirty-two collected by me at Ningkwo, Anhwei Province (see Schmidt, 1927) and find that the tubercular scales are 3-3 in nineteen, 3-4 in two, 2-2 in one, and 1-1 in but a single specimen. The Yenping specimen, also recorded by Schmidt (1927), has three of these scales on a side, as does No. 31121 from Shansi (Schmidt, 1927). Among six Changsha examples the tubercular scales are 3-3 in three, 2-3 in two, and 3-4 in one.



Fig. 1. *Gekko japonicus hokouensis*, new subspecies.

Tubercular scale at base of tail in type, A. M. N. H. No. 35090, six times natural size.

The following table should help to make the matter clear.

| | ANHWEI SERIES 23 Specimens Nos. 31124-135, 31137-146, 31202 (<i>japonicus</i> <i>japonicus</i>) | HOK'OU SERIES 14 Specimens Nos. 35087-100 (<i>japonicus</i> <i>hokouensis</i>) | YENPING SERIES 14 Specimens Nos. 33014-021, 33025, 35156-160 (<i>subpalmatus</i>) |
|-----------------------------------|--|--|---|
| Dorsal Tubercles | Numerous | Numerous | Lacking in 13 |
| Webbing | Little | Little | Pronounced |
| Preanal Pores Average | 5-8 6.4 | 6-7 6.1 | 10-11 10.7 |
| Tubercular Scales Base of Tail | 1-1 in 1 | 1-1 in 13 | 1-1 in 13 |
| Length, Snout to Vent | 1 > 57 mm. 23 < 61 mm. | 11 > 67 mm. 14 < 66 mm. | 7 > 70 mm. 14 < 77 mm. |

The new subspecies, *hokouensis*, seems to be a plateau and foothill form of typical *japonicus* of the low river plains. It illustrates a development in the direction of the high mountain and forest species, *subpalmatus*.

The occurrence of typical *japonicus* at Yenping (Schmidt, 1927) does not harm my theory of distribution because the specimen undoubtedly was taken in the river valley there, which is probably less than 500 feet above sea-level. My series come from the range of mountains a few miles from the city of Yenping. The mountains of this range reach an altitude of more than 4000 feet.

Gekko subpalmatus Günther

Sixteen specimens, fourteen from Yenping (Nos. 33014-21, 33025 and 35156-60), and two from Ch'ungan Hsien (Nos. 34970-71), represent this species. Schmidt (1927) reported one example from Wanhhsien, Szechwan Province, and three from Fukien. At least two of these three Fukien specimens are from Yenping.

Thirteen of the fourteen Yenping specimens are typical in lacking the dorsal tubercles; having fully webbed toes; tubercular scales at the base of the tail 1-1; and, in the males, 11 preanal pores on each side. The three largest females among nine measure from snout to vent 76, 75 and 74 mm., respectively, the largest males among four only 74, 71 and 57 mm. There are 5 dorsal bands in all but three examples.

The fourteenth from Yenping, a female No. 35156, differs from the rest in having an abundance of dorsal tubercles; the scales at the base of the tail in two rows on a side, three or four scales to a row; and a uni-

formly colored dorsum. It measures 66 mm. from snout to vent. This specimen is unique in having so many tubercular scales at the base of the tail and lacking a dorsal pattern. It resembles *subpalmatus* in the webbing of the toes, its large size and general form, while approaching *japonicus* in the presence of dorsal tubercles. Stejneger (1925) records a specimen collected at Foochow by Mr. Sowerby that may represent the present form. Unfortunately, he fails to give the number of tubercles at the base of the tail, the size and sex, and dorsal coloration, but dismisses the matter by considering it a seaport cross between *japonicus* and *subpalmatus*. Foochow may have been given as a general locality, so it is entirely possible that this gekko was taken in the nearby mountains and, together with No. 35156, represents a new form. The relationship of Yenping and Foochow material to that from Kuatun is more than apt to be remote. I hesitate to describe No. 35156 as the type of a new form because of its close habitat association with typical *subpalmatus* in a region where gekkos are very scarce and because only one specimen was secured.

The two from Ch'ungan Hsien are small in size and agree well with typical *subpalmatus* in having fully webbed toes, lacking the dorsal tubercles, having the tubercular scales at the base of the tail 1-1, and ten preanal pores on a side in the male.

Boulenger (1899) records a specimen from Kuatun. The only Szechwan example that I have seen has a depression across the middle of each of the single tubercular scales at the base of the tail.

Gekko swinhonis Günther

One hundred and seven of these gekkos from the Western Hills near Peking (Nos. 29511-617), and fifty-eight from Tsinan, Shantung Province (Nos. 29743-800), are in the collection. Schmidt (1925) has already reported on eighty-three additional ones from Chihli and Shansi.

He found that among twenty-one males the number of femoral pores ranges from 6 to 9 with an average of 7.4, while in my Tsinan series, among twenty-one specimens, the range is from 6 to 10 with 8.4 as the average. In both series 8 pores occur the greatest number of times. In *G. japonicus*, Schmidt found that among thirteen males the number of pores ranged from 5 to 8 with 6.3 as the average and 6 occurring the greatest number of times.

The size of the median pair of postmentals varies but these scales are smaller in this series than in my series of *japonicus*. One of the specimens from the Western Hills has a median postmental.

Among the one hundred and seven from the Western Hills, each of the three largest, all females, measured 61 mm. from snout to vent.

The characters generally used to distinguish *swinhonis* from *japonicus*, webbing, dorsal tubercles, and size of postmentals, are good enough when material is at hand, but in the absence of such they are anything but easy. Typical *japonicus* at best has only a slight web while *swinhonis* frequently has large tubercular scales. The size of the postmentals is variable in both species. In my large series I notice that the scales of *japonicus* are always much finer than those of *swinhonis*. The tubercles in *japonicus* are quite regularly distributed over the dorsum, while the enlarged or tubercular scales of *swinhonis*, when present in numbers, are irregularly arranged and concentrated along the mid-lateral regions of the dorsum.

There is nearly always more pigment on the lower labials of *japonicus* than on those of *swinhonis*. In fact, lower labials of the latter are generally unpigmented.

Schmidt and I have failed to find among two hundred and forty-eight specimens from five localities in Chihli, Shantung, and Shansi, a single one presenting great difficulty. However, when other series from localities farther to the south in the east, and to the north in the west, are available, the *japonicus-swinhonis* question may well be raised again, for the discovery of *japonicus* in central Shansi (Schmidt, 1927) is puzzling.

HEMIDACTYLUS

Hemidactylus bowringii (Gray)

Twenty-five specimens, twelve from Futsing Hsien (Nos. 34181-192), twelve from Yenping (Nos. 33022-24, 33026 and 35148-55), and one from Foochow (No. 35185), show that this gekko is common in the lowlands of northern Fukien. Stejneger (1925) has eight examples from Foochow, while Schmidt (1927) records a single one from Yunnanfu. Mell (1922) confirms older reports of its occurrence in Kwangtung.

My only adult male from Yenping has fifteen pores on each femur, but three from Futsing have 14-14, 13-14, and 13-14 pores, respectively.

Hemidactylus frenatus Duméril and Bibron

The range of this species is extended into southwestern China by eight examples collected at Yuan Kiang, Yunnan Province, by Walter Granger (Nos. 35221-28). Schmidt (1927) has already reported on one hundred and fifteen from Hainan.

In the new series the femoral pores vary from 25 to 29 in the four males. There is no great variation in the postmentals.

Agamidæ**ACANTHOSAURA*****Acanthosaura lamnidentata* Boulenger**

Thirty-six specimens from Ch'ungan Hsien (Nos. 33539-47 and 34683-709) and sixteen from Yenping (Nos. 33001-013 and 35161-63) make up the lot of this species. Schmidt (1927) records seven examples from near Yenping also in the Third Asiatic Expedition's collections. Boulenger (1899) records two specimens collected in Ch'ungan Hsien ("Kuatun"). Stanley (1914) also lists this species from "Fokien."

In the series from Ch'ungan Hsien, the six largest females average 108 mm. in body plus head-length, while the four largest males average only 88 mm. In this same lot the tails of the females vary from 0.59 to 0.60 of the total, while those of the males vary from 0.62 to 0.64.

Ten females from Ch'ungan Hsien contained from 8 to 22 well-developed eggs, the average for all being 14.6. On July 16 the one with twenty-two eggs was brought in and on the twenty-second another gravid female was bought.

This is strictly a mountain species that inhabits forests and bamboo groves. Near Yenping I saw them most often on trees but about Kuatun a colony lived in a boulder-strewn valley. The boulders were vine-covered and over and among them the lizards ran. When alarmed they merely dash away without attempting to secrete themselves in any of the abundant cracks and crevices. When picked up they often bite and try to escape at first but usually do not struggle long.

One individual turned from dull to distinct green while I watched it. This color change is rapid.

Anguidæ**OPHISAURUS*****Ophisaurus harti* Boulenger**

Plate XVII Figure 1

Thirty-two specimens of the Chinese "glass-snake" were secured in Ch'ungan Hsien (Nos. 33536-38 and 34941-69). In addition to this, four lots of embryonic material (Nos. 34493 and 35451-53) were collected in the same locality.

This species was described by Boulenger in 1899 from four specimens collected at Kuatun. It has been reported from Formosa by Van Denburgh (1909) and Stejneger (1919), and from Chekiang Province by Stejneger (1925). Additional Fukien records are by Werner (1909); Stanley (1914 and 1916); Schmidt (1927, Shaowu); and Stejneger

(1919, Foochow).¹ Moquard (1905 and 1910) has reported it from Tonkin.

The specimens at hand agree well with others already reported. Since my series is so large I am able to give a detailed description and clear up a few minor points.

In all the adults the ventral scales are in ten longitudinal series, while the dorsals range from 16 to 19, the majority having 18. There is no apparent difference between the sexes as regards this character. The dorsal scales, as determined by a count of the five largest examples of each sex, are in 96-101 transverse rows from the beginning of the lateral groove to the vent, with no apparent sexual discrepancy.

The following data were compiled from a study of the five largest examples of each sex.

The distance from tip of snout to vent ranges from 227 to 235 mm. with an average of 232 mm. in the females; from 230 to 245 mm. with an average of 238 mm. in the males. The tails vary from 0.60 to 0.62 of the total with no difference between the sexes.

The distance from the tip of the snout to the ear opening is 21 mm. in four of the five females while it ranges from 25 to 27 mm. with an average of 26.2 mm. in the males. The width of the head ranges in the females from 13 to 14.5 mm. with 13.7 mm. as the average. In the males the range is from 17 to 20.5 mm. with an average of 18.5 mm. Thus far the only noticeable difference between the sexes is in length and breadth of head.

There has been some confusion as regards color. Boulenger (1899) has already brought out the main points: (1) the complete change with maturity and (2) the gaudiness of the male as compared to the female. Boulenger's excellent figures illustrate these points nicely. All the males in my series have the cross-blotches (of blue in life) but the females vary from a uniformly marked dorsum to one decorated almost as conspicuously as that of the male. In life there may be a difference in the intensity of the blue. Among fifteen adult females two are unmarked, four are very faintly spotted, three are faintly blotched, while six are distinctly marked like the male but with narrower and less intense markings.

On August 17 a "glass-snake" guarding five eggs was discovered in Upper Kuatun valley. The eggs were deposited in a small, irregular cavity two to three inches below the surface of the floor of a thinned-out bamboo grove. The nest was at the edge of a pile of decaying bamboo

¹This specimen is recorded as having come from "within 200 miles of Foochow" but its collector, Mr. Kellogg, has since told me that the 200 should read 20.

waste which probably afforded suitable material in which to deposit the eggs. The adult, a female, took flight at slight alarm. She was irregularly coiled about the eggs and not in close contact with them. The eggs, not adherent, were white and ranged in length from 24.5 to 26.8 mm., in width from 16.2 to 18.5 mm. One egg contained a barely pigmented embryo 99 mm. long.

On this same day a batch of 5 similar eggs was bought. One contained an unpigmented embryo 71 mm. long.

The following day in a lower valley I saw a nest containing 6 eggs also guarded by a female *O. harti* (No. 34942). It was located immediately beneath a big, flat stone lying out in an open, dry field fully exposed to the sun. There was no other significant difference between this nest and the one described above. The eggs were slightly smaller, ranging in length from 22.5 to 23.1 and in width from 15.9 to 16.8 mm.

The last nest, also located near a pile of decaying bamboo waste, was examined on August 28 (Plate XVII, fig. 1). It was strikingly alike, and near to, the one discovered August 17. Even though the female took flight at a slight disturbance of her nest, it was on the very edge of a much-used path. The six eggs were about the same size as those seen August 18.

Finally, on September 3, seven eggs were bought containing well-developed embryos.

Between the 3d and 10th of September the remaining eggs of one of the two lots secured August 17 hatched into young 143, 142 and 134 mm. long, respectively, their tails occupying 0.56 to 0.57 of the totals.

No. 34944 contains 6 well-developed eggs.

This species is very secretive. I was never fortunate enough to run across one rearing abroad. When handled it does not bite.

Lacertidæ

APELTONOTUS

Apeltonotus sylvaticus, new species

TYPE.—A. M. N. H. No. 34975; ♀; Ch'ungaa Hsien, northwest Fukien Province, China; April-September, 1926; Clifford H. Pope.

DIAGNOSIS.—This species differs from *dorsalis* in having a less distinct collar, much shorter limbs, more scales across the middle of the back, a greater number of transverse series of ventral plates, and a distinctive color pattern.

DESCRIPTION OF TYPES.—Head twice as long as broad, its length contained four and one-half times in total length to vent; snout acutely pointed, a little longer than postocular part of head, with a sharp canthus, and a vertical, slightly concave loreal region. Neck slightly narrower than head. Hind limb stretched forward fails

to reach elbow; fore limb stretched backward fails to touch knee; hind limb 0.42 of distance from tip of snout to vent; foot slightly longer than head; tail long, slender.

Nasals not in contact behind rostral; rostral and frontonasal forming a short suture; frontonasal longer than broad; frontal as long as its distance from end of snout, narrower behind than in front; parietals about one and one-half times as long as broad, outer border convex; interparietal small, slightly longer than frontonasal; occipital very small; 2 large and 2 small supraoculars; supraciliaries 5, separated from supraoculars by a series of granules. Rostral just separated from nostril; a single postnasal; anterior loreal barely half as large as posterior, only third and fourth upper labial in contact with the posterior loreal. Four pairs of chin-shields, first pair completely in contact, second barely separated posteriorly.

Scales on back largest, strongly keeled; those on sides granular, the two types gradually merging, slightly intermixed; 44 scales across middle of body. Ventral plates in six longitudinal, twenty-four transverse rows, plates of outer longitudinal row distinctly keeled and pointed, remainder barely so. Preanal plate large, smooth, bordered by a semicircle of 6 plates as large as those of last transverse row of ventrals; 4 of 6 are anterior, 2 lateral. Three femoral pores on each side; 26 lamellæ under fourth toe. Caudal scales strongly keeled, twice as long as largest dorsals.

Color, dark green above, light below, lightest on the throat. A continuous white stripe from subocular to base of hind leg. This line passes just below tympanum, above base of fore limb, and along fourth to sixth lateral rows of scales; vivid on head and neck, distinctly less so on body.

NOTES ON PARATYPES.—The 4 paratypes (Nos. 34972-974, 34976) and the lot of embryonic material (No. 35467) all come from the type locality. The former agree with the type in having an ill-defined collar; hind legs from 0.43 to 0.47 of the length from snout to vent as compared to 0.48 to 0.52 in five *dorsalis* (among which only one falls below 0.51); 41-42 scales across the back against 28-35 in *dorsalis*; 28-32 transverse series of ventrals compared to 24 in *dorsalis*, and a uniform color pattern varying only a little in the intensity of the white line on the body.

The chin-shields are always 4-4 with 2 pairs almost completely in contact in all but one in which those of the second pair are more than half separated. Boulenger (1921) says that in *dorsalis* three pairs are in contact but I find upon examining six specimens only two pairs in contact in three, two and a fraction of the third in two, and three on one side in contact with two on the other in an irregular one. The slight difference in this respect between the two species is negligible. With one exception the nasals form a suture in *dorsalis*, but in *sylvaticus* they are in contact in only two out of five, the rostral touching the frontonasal in three. The femoral pores are 3-3 in two, 2-2 in one, and 2-3 in one. The longitudinal series of ventrals are constantly 6, all of which are keeled in one, the outer distinctly so in one, while in the other two there is only a trace of a keel even on the outer series, the rest lacking it entirely. The type is the longest, measuring 61.5 mm. from tip of snout to vent. No. 34976 has the longest tail, 200 mm., while its body is 58 mm. long. The lamellæ under the fourth toe in the 4 paratypes are 25, 26, 27 and 29, respectively.

The type and another gravid female held 3 well-developed eggs apiece and were taken on July 7 and 9. The lot of four embryos (No. 35467) was taken from as many almost spherical, finely mottled, pale

brown eggs brought in on August 19 at Kuatun. One of the eggs measured 10.8×8.1 , and another 10.9×8.6 mm.

These lizards had a very erratic distribution in the Kuatun region for they were common in a well-forested valley across the creek from Ch'ilichao but extremely rare or absent everywhere else. I encountered them there many times but so swiftly did they run over the forest floor and so wary were they that their capture was very hard to effect. They do not even suggest *Takydromus* in habits for I saw them only in or at the edge of forests and I could detect no ability to climb on their part.

The discovery of this genus in China is very significant and its occurrence in Formosa may be safely predicted.

TAKYDROMUS

Takydromus septentrionalis Günther

In the present collection there are one hundred and fifty-one specimens, three of which are from Hok'ou (Nos. 35114-116), three from Futsing Hsien (Nos. 34164, 34169 and 34171), thirty-five from Yenping (Nos. 33027-046 and 33048-062), and one hundred and ten from Ch'ungan Hsien (Nos. 33492-516, 33518-528, 33530-535, 34977-35044). Five lots of eggs come from Ch'ungan Hsien (Nos. 35460-64). Schmidt (1927) has already reported on thirty specimens from Anhwei, Hunan and Szechwan Provinces, also a part of the Third Asiatic Expedition's collection.

Hok'ou is the only new locality record, for Boulenger (1899) has recorded six examples from Ch'ungan Hsien ("Kuatun"), and Stejneger (1925) records three from Futsing and two from Yenping. Stanley (1914) also includes "Fokien" specimens in his list of Chinese reptiles. Mell (1922) found it common in northern Kwangtung, especially along the Hunan border.

The present series exhibits no notable variation. A summary of four important characters follows.

CHIN-SHIELDS.—In every specimen but one, 3 pairs were found. This one, from Ch'ungan Hsien, has 4 on one side and 3 on the other, one of these slightly notched as if a fourth had been almost formed on that side too. Stejneger (1925) reports a similar condition in a specimen from Nanking. Boulenger and Werner have observed it but also in a very limited number of specimens.

FEMORAL PORES.—These are invariably 1-1.

DOREAL LONGITUDINAL SCALE ROWS.—The most irregular in this respect are the three specimens from Futsing, all of which have eight rows, the two innermost dropping out a short distance behind the fore limbs, the next two running some distance back before disappearing.

By far the greatest number of specimens have 6 rows, the inner pair of which are small and nearly always drop out at a point slightly nearer the fore than the hind

limbs. Mell (1922) found this to be the case in his series. The three Futsing specimens excepted, there were six with a seventh row extending only a short distance posterior to the fore limbs, while in two from Yenping, the fifth and sixth dropped out anterior to the axilla, leaving only four rows for almost the entire length of the body.

VENTRAL LONGITUDINAL SERIES.—These were uniformly 8, but in thirty cases, instead of only two lateral rows of enlarged scales adjacent to the ventral plates on each side, there were three.

In fifty-nine specimens the rostral and frontonasal were in contact.

Between August the 2nd and 25th four lots of eggs were brought in, all containing well-developed embryos. Three had 2 eggs each while one had 4. They were dug up by men weeding the high tea fields about Kuatun. The eggs are dull white faintly mottled with pale brown. The length of the eggs of three lots ranged from 12 to 14 mm., while the lesser diameter ranged from 9 to 11.2.

This species is found at higher altitudes in the southern part of the range and is scarce along the low coastal plain even as far north as Futsing. Mell reports it from 500–900 m. in Kwangtung. It was common in the highest valleys of the Kuatun range. About Ningkwo it is found at very low altitudes.

The number of eggs developed by one female varies from 1 to 6 with 3.2 as the average obtained from examination of twenty-three gravid specimens.

It is strictly a "grass lizard" of the open, sunny valleys and mountains. It lives above ground in the high grass. When alarmed it makes short dashes by jumping and running through the stems near their tops. Those observed near Ningkwo in Anhwei had a habit of suddenly changing their direction and then apparently vanishing. For this reason only they were hard to secure because they do not go far before pausing. The very long tail seems to be largely responsible for their ability to remain so high above ground among the grass tops.

***Takydromus sexlineatus meridionalis* (Günther)**

A series of twenty-three specimens, twenty-one from Futsing Hsien (Nos. 34157–163, 34165–34168, 34170 and 34172–180) and two from Ch'ungan Hsien (Nos. 33517 and 33529), represent this species. Although it has not been previously reported from the latter locality, Stejneger (1925) records six examples from Futsing and four from Yenping. Schmidt (1927), in his papers on former Third Asiatic Expedition collections, records thirteen from Fukien Province and two hundred and fourteen from Hainan Island.

All of the twenty-three specimens have 3 pairs of chin-shields, one

femoral pore on each side, and 12 longitudinal rows of ventrals. In one, a fifth and sixth dorsal row extends to the middle of the back but all the rest have the usual four rows. The rostral and frontonasal are well separated in all but three while they actually meet in only one of these. The largest example is a female 325 mm. long. The series agrees well with Stejneger's from Futsing.

Mell (1922) reports that it is common in the Canton-Hongkong region while I found it abundant on the Hainan plain. Obviously, then, this species inhabits the coastal plain from Fukien southward.

In my series the females as well as the males have rows of black-edged ocelli but in the former they are much less distinct, especially posteriorly.

Two females contained 2 eggs each while one contained 3.

Like *septentrionalis* it is a grass lizard inhabiting open country. It also lives up in the grass well above the ground.

EREMIAS

Eremias argus Peters

Eighty-five specimens, seventy-nine from Tsinan, Shantung Province (Nos. 29801-879), and six from the Western Hills, Peking (Nos. 29505-10), represent this species.

Schmidt's 1927 report included seventy-five *argus* from Chihli Province and one hundred and seventy-two *barbouri* and thirty *branchleyi*, all from Shansi Province.

The seventy-eight Shantung specimens may be divided into (1) those in which the subocular fails to enter the labial border and (2) those in which it does enter.

The sixty-three that make up the first group have been sorted over, the eleven largest of each sex examined, and found to average fifty-five and a fraction scales across the back for both sexes with a range in the males of 49-60, in the females, 47-69. Schmidt (1927) gives 57 and 56 as the averages for a series of Chihli *argus*. Since the type locality for this species is Chefoo, Shantung, we may conclude that these sixty-three are representatives of the typical form.

The fifteen that fall into the second group (Nos. 29804, 29812-13, 29823, 29825, 29828, 29834, 29836, 29844-45, 29847, 29851-53, 29861) average forty-eight and a fraction scales across the back, with the extremes in the six males at 46 and 51, and the nine females, 40 and 59. In shape of head as well as in dorsal pattern they are indistinguishable from the rest of the 78 Shantung specimens.

E. brenchleyi is distinguished from *argus* by (1) the descent of the subocular to the labial border, (2) a low dorsal count, (3) the tendency to uniform coloration, and (4) a more pointed head.

The second group, then, agrees with *argus* in the first character, is slightly nearer to it than to *brenchleyi* in the second, but fails to show an appreciable amount of agreement in the last two. Since all of the seventy-eight come from one locality it is safe to conclude that they are *argus*, the range of variation of which, through them, is greatly extended, and the gap between the two forms narrowed.

I have carefully compared the new Shantung lot with the series of *barbouri* and find it impossible to make any distinction in coloration. The small difference in dorsal scale count is entirely eliminated by the range in variation of *argus* described above. The two diagnostic characters of *barbouri*, in the light of new material, fail to hold true, so I suggest that it be put in the synonymy under *argus*.

Schmidt was puzzled by the occurrence of *brenchleyi* at So Huang in eastern Shansi where it is "inserted between the ranges of *barbouri* and *argus*" or, as we now have it, directly in the range of *argus*. So Huang is in the mountains so *brenchleyi*'s presence there might be explained by altitude preference. Since the new material has so greatly lessened the gap between these two associated forms, I believe that they should be written *Eremias argus argus* and *Eremias argus brenchleyi*. Additional material from high altitudes is much needed.

Fourteen females contained from 2 to 4 eggs apiece, averaging 3.

Scincidæ

MABUYA

Mabuya multifasciata (Kuhl)

Walter Granger collected nine specimens at Yuan Kiang, Yunnan Province (Nos. 35212-20). Schmidt (1927) has already reported two examples from this Province and forty-eight more from Hainan.

In the present series of nine the supraciliaries are uniformly 6 and the upper labials are 7 except on one side of one specimen where they are 6. The subdigital lamellæ under the fourth toe are 20 in the four males and 19 in all but one of the females which has 20. The scales around the body are 30 to 32 with 30.7 as the average. The dorsal scales down the back average 43.7 while those down the belly average 52.8. One female measures 122 mm. from snout to vent while two other females and one male measure just 120 mm. This series conforms remarkably well with the Hainan one.

SPHENOMORPHUS

Sphenomorphus boulengeri Van Denburgh

Twenty-seven specimens of this species were secured. Fourteen were collected at Yenping (Nos. 33169-81 and 33206), and thirteen in Ch'ungan Hsien (Nos. 33582-86, 34875, 34891, 34894, 34903-4, 34907-8 and 34913).

In twenty-two of the twenty-seven the supralabials are 7 on a side, the fifth under the eye. Eight appear on one side in four, and six in one.

The color pattern of the young is like that of the adult.

Oddly enough Van Denburgh's color description fits neither the Hainan specimens nor the Fukien series. He speaks of a "pale yellowish brown dorsolateral line" from the temporal region to the base of the tail, a "blackish brown band" from the nostril to the base of the tail, a "definite light lateral line" and a "dark band" starting with spots on the labials. I find only the blackish-brown band. Between it and the belly is a bluish area profusely spotted. The profusion of spots is everywhere evident in mine as in his. A light line extends from below and just behind the eye as far back as the arm in some specimens, so this may be an indication of his "definite light lateral line." Color pattern in these skinks is a very poor character unless considered in specimens from the same locality, so this apparent difference should not be taken too seriously.

This is distinctly a mountain and forest skink. It was not seen in open country on either plain or plateau. At Kuatun it ranges into the higher valleys.

The position of this series is fairly certain even though there are differences between my counts and Van Denburgh's. The following table shows clearly how my series compares with his lot of twelve.

| | Patch of Enlarged Scales Back of Thigh | Scales Under Fourth Toe, Extremes and Mean | Percentage with 3 Supra- oculars in Contact with Frontal | Scales Around Body, Extremes and Mean | Scales Down Back Extremes and Mean |
|--------------------------|---|---|--|---|---|
| 27 Fukien Specimens | Present | 18-20 19.2 | 4 | 36-40 37+ | 69-80 74+ |
| 12 Formosan Specimens | Present | 22-23 22+ | 42 | 38-40 38.7 | 67-78 72.5 |

Van Denburgh says that in the types the frontal is broadly in contact with the frontonasal so I assume that such is the case in the entire

series. If my assumption is well founded we have an additional character linking the two series, for such is the case in my entire lot. The difference in the number of scales under the fourth toe is of little importance. It might be partly due to individual methods of counting. More important is the greater number of supraoculars in contact with the frontal.

There can be little doubt as to the validity of this species since at Yenping I found it associated with typical *indicus* and at Kuatun with *formosensis*. Out of a series of more than one hundred examples of these three closely related species there is only one specimen showing the slightest sign of intergradation. The three species can be separated instantly by sight.

Schmidt's (1927) *S. leveretti* from Hainan undoubtedly belongs here. The only differences I can detect are a slightly lower number of scales down the back (an average difference of six scales) and a longer hind leg in *leveretti*. In color pattern the two are identical and the patch of enlarged scales behind the thigh is present in the Hainan form. This question will be taken up conclusively in the Expedition's final reports.

Sphenomorphus formosensis Van Denburgh

Sixty-nine specimens of this species were collected in Ch'ungan Hsien (Nos. 33571-81, 33587, 34872-74, 34876-90, 34892-93, 34895-902, 34905-06, 34909-12, 34914 34916-22, 34924-25, 34927-30, and 34932-40). It was not seen elsewhere.

All but two of thirty examples have 7 upper labials on each side, the fifth under the eye.

The color is quite characteristic and there is no difference between young and adult. Van Denburgh's color description of *boulengeri* seems to fit this species better than his description of *formosensis* but fortunately I have a specimen of the latter before me. Although it is generally lighter and lacks the light lateral band of my *formosensis* the two are strikingly alike. *S. formosensis* from Fukien has the usual light belly. The dorsum is dark olive-brown with a varying number of dark spots distributed in greatest numbers along the sides of the back. There is a dark band from nostril to the hind leg, as wide as three scales at its widest point. This is bordered below along its entire length by a light area, one scale wide at the widest. This light area is separated from the belly color by a varying amount of dark pigment sometimes in the form of a dark band but often as irregular dark streaks or spots.

This species, it should be noted, was found only in the highest

mountains of the Kuatun range where it inhabited the forests and bamboo groves in great numbers. It is significant that it was not seen in the Yenping mountains.

The following table shows why I place it with Van Denburgh's *formosensis*.

| | Percentage With Frontal Separated From Frontonasal | Percentage With 3 Supraoculars in Contact With Frontal | Scales Around Body, Extremes and Mean | Scales Down Back, Extremes and Mean |
|-----------------------|--|--|---|--|
| 69 Fukien specimens | 5 | 91 | 32-38 34+ (30 specimens) | 67-80 72 |
| 82 Formosan Specimens | 3.6 | 96 | 32-38 34.6 | 64-78 71 |

Three specimens from Yunnan (Nos. 12787, 20988-89), two of which were recorded as *indicus* by Schmidt (1927), have 36, 37, 38 scales around the body and 75, 78, 74 down the back. This indicates that they are *formosensis* rather than *indicus*, especially since the color is more like the former. However, the spots on the back appear as broken lines, so in this respect they resemble neither species. Eighty-two scales down the back and similarity in color also indicate that Schmidt's Szechwan specimen (No. 23555) belongs here.

Sphenomorphus indicus (Gray)

There are twenty-one specimens of this species from Yenping (Nos. 33182-96 and 33199-204) and five from Futsing (Nos. 34146-50). No. 33207 from Yenping is placed here provisionally. Schmidt (1927) reported on seven examples from Fukien, Hunan, Yunnan, and Szechwan Provinces which he listed as *indicus*. Part of these must be referred to *formosensis*. Werner (1909) records a Foochow specimen.

In eighteen out of twenty examples the supralabials are 7 on a side, the fifth just under the eye. The other two are abnormal in having only six on one side.

The coloration of the adults is invariable and strikingly like that shown in Boulenger's plate (1887). The young have a characteristic pattern which at best is only very faintly retained in the adult. On either side of the tympanic opening in the juvenile specimens there is a white spot higher than wide and a little larger than the tympanic orifice. Dorsally its outline is distinct but it runs into the white of the belly below.

A row of five or six very similar spots extends forward on the upper labials, each spot smaller than its predecessor. The series is continued posteriorly from the tympanic opening along the side, fading out just before the groin. The spots become posteriorly not only fainter but more and more irregular in arrangement, size and shape.

Van Denburgh's series of nine from Chekiang may profitably be compared with my Fukien lot.

| | Percentage With Frontal Separated From Frontonasal | Percentage With 3 Supraoculars in Contact With Frontal | Scales Around Body, Extremes and Mean | Scales Down Back, Extremes and Mean |
|----------------------|--|--|---|--|
| 26 Fukien Specimens | 15 | 46 | 34-36 34.6 | 64-72 67.9 |
| 9 Chekiang Specimens | 33 | 77 | 36-38 37.1 | 73-81 76.6 |

The differences in the head scales are not especially significant considering the small number of specimens in the Chekiang series, but it is hard to understand the great difference in dorsal scale count for no two counts overlap. Since Van Denburgh had series of the three related species before him it is certain that he was not confounding them.

It is very doubtful if Boulenger's 1899 series of eleven specimens from Kuatun is really this species for I failed to find any there. Judging by his scale-count (34-36) it is a mixture of *boulengeri* and *formosensis*. Werner's (1910) Foochow specimen with 38 scale-rows is uncertain. Unfortunately, Mell (1922) has not described his Kwangtung series so we remain completely in the dark concerning them. Stejneger's (1925) two from Yenping may be typical *indicus* but more likely they belong to one of the other two species since their scale count is above mine for both Yenping and Futsing. He fails to publish further details.

Schmidt's (1927) three specimens from Yenping have 34-36 scale-rows and the proper color pattern. They undoubtedly are typical *S. indicus*. A young Changsha specimen (No. 17459), also recorded by Schmidt, with 3 supraoculars touching on both sides, 35 scale-rows, 75 scales down the back, and color pattern as much like *indicus* as *formosensis*, is very puzzling and might be placed under either species.

No. 33207 from Yenping is the only one in a series of one hundred and twenty-nine whose color pattern does not conform to that

of one of the three species. Instead of the dorsum being dark olive it is reddish brown. A series of distinct black spots extends along the middle of the back from the neck to the hind legs. A black line, broken along the midlateral region, extends from the eye past the leg and on along the base of the tail. The supralabials are regular and there is no patch of enlarged scales on the thigh. The frontal is not in contact with the frontonasal and two supraoculars are in contact with the frontal on either side. The scale-count around the body is 38 and down the back 73. There are 14 subdigital scales. The specimens measure 53.5 mm. from snout to vent. Its proper position is very uncertain.

In the field *boulengeri*, *formosensis*, and typical *indicus* are not readily confused when their ranges and habits are known, and in the laboratory they may be told at a glance by their distinctive color patterns. In order to render the matter as clear as possible I have made a table which, with the exception of color, only records their differences and this as concisely as possible (see p. 383).

The scale-count down the back is begun at a point opposite the back of the thighs. In all three species there are several with two supraoculars in contact with the frontal on one side and three on the other, hence the percentages given in the divided columns do not make a full hundred. The count of the lamellæ under the fourth toe may be too low by one as I did not count the doubtful one at the base of the toe. The "length" in the next to the last column means the length from snout to vent.

LYGOSAURUS

Lygosaurus sowerbyi Stejneger

Six specimens of this skink were collected at the type locality, Futsing (Nos. 34151-56). Schmidt (1927) recorded the second specimen of this discovery by Mr. Sowerby which was described by Stejneger in 1924.

All of my five adults have 6 upper labials and 9 supraciliaries on both sides. In the two males the lamellæ under the fourth toe number 16 and 17, while in the three females they are 15, 15, and 16. The males have each 30, and the females 28, 28 and 30 scales around the body. The scales down the back could be determined in only one specimen which had 50. The ventrals from anus to chin-shields range in number from 53 to 59 with 56 as the average. The tail is from 0.45 to 0.50 of the total length with no apparent sexual difference. The hind leg of the two males is 0.23 of the distance from snout to vent, while in the three females it is only 0.21.

| | Patch Scales Back of Thigh | Scale Count Around Body, Extremes and Mean | Scale Count Down Back, Extremes and Mean | Percentage with Frontal Separated from Fronto-nasal | Number of Supra-oculars in Contact with Frontal | | Lamellae Under Fourth Toe, Extremes and Mean | Average Length of Largest Four | | Distinctive Juvenile Color Pattern |
|--|----------------------------|--|--|---|---|---------------------|--|--------------------------------|-------|------------------------------------|
| | | | | | Percentage with 3-3 | Percentage with 2-2 | | ♂ | ♀ | |
| <i>formosensis</i> 30 Specimens in Columns 2, 3 and 7; 69 Specimens in Others | Absent | 34 32-38 | 72+ 67-80 | 5 | 91 | 3 | 18.1 16-20 | 75.5 | 86.9 | No |
| <i>boulengeri</i> 27 Specimens | Present | 37+ 36-40 | 74+ 69-80 | 0 | 4 | 70 | 19.2 18-20 | 97.5 | 109.7 | No |
| <i>indicus</i> 26 Specimens | Absent | 34.6 34-36 | 67.9 64-72 | 15 | 46 | 31 | 16-18 16.4 | 78.5 | 81.5 | Yes |

The males have numerous irregularly distributed scales along the sides colored black anteriorly and white posteriorly. In the females the white is almost lacking while the black spots are regularly arranged, one for each scale. Otherwise the sexes are similarly marked.

When compared with *L. salsburyi*, the only differences to be seen are: (1) the slightly lower number of subdigital lamellæ; (2) the shorter hind leg, .21-.23 of the body length instead of .33-.35; and (3) the smaller and narrower head. These differences may be reduced when further specimens come to light, and it is evident that the Hainan form represents at most a subspecies of *sowerbyi*.

LEIOLOPISMA

Leiolopisma modestum (Günther)

Six specimens, two from Yenping (Nos. 33205 and 33208), and four from Ch'ungan Hsien (Nos. 34915, 34923, 34926 and 34931), represent this species. In addition there is a lot of eggs (Nos. 35465) from Kuatun.

On August first six whitish lizard eggs containing scaled and pigmented embryos of this species were brought in at Kuatun. The largest egg measured 9.5×8 mm. They testify to the great altitude to which this species ranges. These tiny skinks were, however, very rare in Fukien.

EUMECES

Eumeces chinensis (Gray)

Figure 2a

A total of one hundred and forty-seven specimens represent this species. Thirty-eight of these come from Futsing Hsien (Nos. 34108-145), ninety from Yenping (Nos. 33047, 33063-74, 33076-116, 33118-35, 33137-43, 33159-62, 33164-68, and 33197-8), six from Ch'ungan Hsien (Nos. 33548, 33552, 33563, 34853-4, and 34869), and thirteen from Hok'ou (Nos. 35101-13). Schmidt (1927) reported six examples, five from Fukien and one from Szechwan Province. Stanley (1914) also records it from Fukien.

Among the ninety from Yenping five have two postnasals while in six the second postmental is paired. Two have the postmental divided. Stejneger's (1925) series of twenty-five from this locality showed about the same amount of variation in regard to the presence and absence of postnasals but none of his lot had the second postmental divided.

In my thirty from Futsing four have a pair of postnasals while two more have only one each. The second postmental is divided three times. The nuchals are very irregular, but 2-2 occurs most frequently. In all of ten specimens counted, the rows of body scales are 24.

In the Hok'ou series none has a postnasal and the second postmental is divided in only two specimens. The nuchals vary, but 1-1 occurs most often. The body scale-rows are uniformly 24.

Among the six from Ch'ungan one has a divided second postmental and one a single postnasal.

Summarizing we see that there is a great uniformity in *chinensis* from the Fukien-Kiangsi region. Only 0.06 have a pair of postnasals while just 0.08 have the second postmental paired. The other variations are too slight to be worth recording.

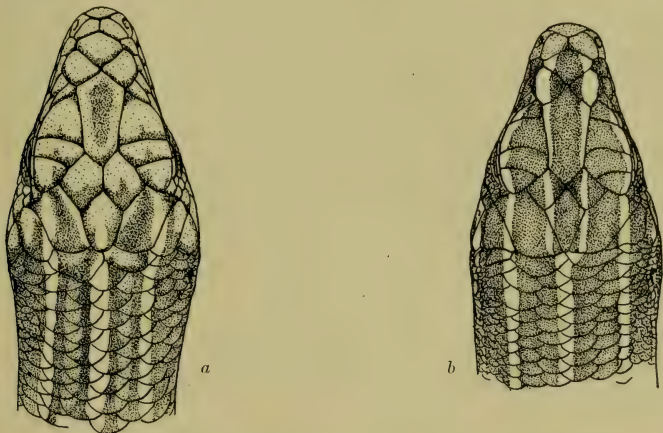


Fig. 2. *Eumeces chinensis* (Gray) and *Eumeces elegans* Boulenger.

a—Head and anterior dorsal pattern of juvenile *Eumeces chinensis*, A. M. N. H. No. 34144, five times natural size.

b—Head and anterior dorsal pattern of juvenile *Eumeces elegans*, A. M. N. H. No. 34770, six times natural size.

The maximum size is attained in a Futsing specimen 116 mm. from snout to vent. Another from Futsing measures 115 mm. which is the length of the largest Yenping example.

In the young, three yellowish stripes extend down the back on a very dark ground color. The central stripe follows the suture between the two mid-dorsal scale rows, the other two the next suture on either side but one. The central stripe ends at the parietals but the other two extend on to the supraoculars. All of the stripes disappear on the anterior half of the tail. The many lateral spots sometimes appear to be set in rows but generally they are quite evenly distributed over the sides. The

upper labials are white with dark borders and the head shields are bordered or centered with black.

The juvenile pattern is lost probably before maturity. Eight specimens measuring 55 to 60 mm. from snout to vent are in the transitional stage, the pattern having almost disappeared in some while it is obscure in all. *E. elegans* is a distinctly smaller species but the pattern is retained in perfection by examples of that species 60 mm. long. Here we have a marked difference between these two skinks. Their differences are summarized under *elegans*.

In the light of new material I have re-examined Schmidt's young *pulcher* (No. 31226, which measures 52 mm. from snout to vent) and found that it differs from juvenile *chinensis* in (1) the broken condition of the two dorsolateral stripes which causes them to look like rows of connected spots, (2) smaller and more contrasted lateral spots, (3) a darker belly, tail, and general background, (4) much more black and much less white on the upper labials which appear to be black with large central white spots. In other respects the *pulcher* pattern closely resembles that of *chinensis* rather than *elegans*. Schmidt's *pulcher* (No. 31205), though quite large (118 mm., snout to vent), retains distinct dorsal stripes. This may be a clue to another color difference between *pulcher* and *chinensis*.

I observed this to be the common skink of plain and plateau. It abounds along roads, paths, irrigation terraces and similar places all through the open, flat country and low "grass mountains." It was not seen in the valleys about Kuatun. Mell's (1922) observations in Kwangtung confirm mine.

***Eumeces elegans* Boulenger**

Figure 2b

Nineteen specimens from Yenping (Nos. 33075, 33117, 33136, 33144-158 and 31363), one hundred and seventy-nine from Ch'ungan Hsien (Nos. 33549-51, 33553-62, 33564-70, 34710-852, 34855-68, and 34870-71), and five lots of embryonic material also from Ch'ungan Hsien (Nos. 35454-459), make up the series of this species. Schmidt's (1927) former report records forty-nine specimens from Anhwei, Fukien, Hunan, Szechwan, and Yunnan Provinces.

My series of one hundred and ninety-eight specimens forms no exception to the rule of remarkable uniformity reported for this species. Fifteen of Schmidt's forty-nine came from Fukien Province and Stejneger (1925) lists eight additional ones from there. Mell (1922) says it is

common in Kwangtung Province. Stanley (1914) also gives Fukien records.

I examined one hundred and four of the Ch'ungan Hsien specimens in some detail and failed to find a postnasal or a second undivided postmental. The upper temporal of the second row is always the largest. The nuchals are uniformly 1-1 and in every case but one the posterior loreal touches two labials and in that it is in contact with three. In the Yenping series of nineteen, two specimens have only one nuchal each, otherwise they are perfect conformists. The color is quite uniform.

The young are gaudily marked with five gilt stripes on a blue-black ground color. Three of the stripes are dorsal and two lateral. The mid-dorsal one follows the line of sutures of the two central rows of scales, while each of the other two occupies the middle of a scale-row. The mid-dorsal stripe forks at the base of the interparietal to rejoin on the internasals after crossing the head lengthwise. Each lateral stripe begins on the posterior upper labials and runs down the middle of a scale-row for the greater part of its course. All five stripes disappear on the anterior half of the tail. The upper labials are white with dark borders.

The juvenile pattern is retained until after maturity, No. 33147 being a striped female 70 mm. long containing eight well-developed eggs. The ground color in these mature specimens is much lighter and the stripes more gray than gilt. The pattern probably disappears soon after maturity but this point has not been demonstrated. In a specimen 81 mm. from snout to vent the pattern has faded and the ground color is no longer dark. Since the second largest specimens among a series of one hundred and ninety-five measure but 93 mm., the above example is near the average adult size.

Young *elegans* differs from juvenile *chinensis* chiefly in (1) having five instead of three longitudinal stripes, (2) the relation of two dorsal stripes to the scale rows, (3) the forking of the mid-dorsal stripe and its subsequent extension in double form to the internasals, (4) lacking the lateral spots, (5) the retention of the pattern in slightly modified form even after maturity. Although *chinensis* attains a length of 116 mm., it loses the juvenile pattern by the time it is 60 mm. long, while *elegans*, with a maximum length of 96 mm., may retain the pattern even after it has reached a length of 80 mm.

During August, 1926, several lots of eggs were dug up in the high tea fields about Kuatun. On the 11th I noticed many recently hatched specimens abroad. Between the 16th and the 21st young emerged from at least two batches of eggs being kept by us. The number of eggs per

batch ranged from 7 to 10 in the five or six batches secured. The eggs of a batch of seven fully developed ones ranged from 24 to 26 mm. for the greater diameter, and from 12 to 13.2 for the lesser. The shell is a yellow-brown.

This species is obviously a mountain form never seen on the open, irrigated plain of the plateaus and valleys. At Kuatun it reaches the highest places. Stejneger's Foochow record indicates that it descends almost to sea-level provided there are mountains at these low altitudes to afford shelter. I failed to find it in the Futsing region which is near Foochow. This is hard to explain, since I worked in the mountains as well as on the plains.

My largest specimen measures 96 mm. from snout to vent while the next two in size measure 93 mm.

SERPENTES

Typhlopidae

TYPHLOPS

Typhlops braminus (Daudin)

Four examples from Foochow (Nos. 35186-189), and one from Nananfu, Kiangsi Province (No. 31779), represent this species. The latter was presented by Thomas S. Crossley.

Stanley (1914) reports this snake from Fukien, as do Stejneger (1925, Futsing) and Schmidt (1927, Yenping). It has long been known from Formosa (Stejneger, 1907, 1911; Oshima, 1910; Steindachner, 1913, etc.), and Smith (1923), as well as myself (Schmidt, 1927), found it common on Hainan. Mell (1922) now reports it common in Kwangtung where he found it up to 330 mm. above the sea. I could not discover it in Futsing Hsien.

There are 20 rows of scales in all of the specimens.

Boidæ

PYTHON

Python bivittatus Schlegel

Walter Granger secured in 1926 a small python at Yuan Kiang, southwest Yunnan Province (No. 35231).

Stanley's 1914 record of Fukien *reticulatus* doubtless belongs here. Mell (1922) records *bivittatus* from Kwangtung and Schmidt (1927) reported seven Hainan specimens. In 'Blue Tiger,' page 146, Harry R. Caldwell tells of killing a hundred-pound python near Yenping and he also gives a good photograph of the snake, Plate VI. Pythons are well known to the Fukien Chinese. Unfortunately, I did not secure a specimen.

The upper labials in No. 35231 are 13-13, the lower 20-20, and the oculars 8-8. The scales on the neck are 55, at midbody 69, and before the anus 46. The total length is only 863 mm.; 14 per cent of which is occupied by the tail. A rat, probably of the domestic variety, was found in the stomach.

Colubridæ

SIBYNOPHIS

Sibynophis collaris chinensis (Günther)

Twenty-seven specimens, twenty-one from Ch'ungan Hsien (Nos. 33736-737, 34522-538, and 34540-541), five from Yenping (Nos. 33387-391), and one from Futsing Hsien (No. 34102), make up the series of this species. No. 34539 is embryonic material from Ch'ungan Hsien.

Schmidt's *hainanensis* described from Hainan in 1927 has a low ventral count (167) well within the range (159-180) of *collaris collaris* and probably belongs in the synonymy of that form.

S. grahami with only 83 subcaudals is puzzling because *collaris* from regions east as well as west of Yunnan have high caudal counts. Unfortunately, both the American Museum specimens have incomplete tails. In color there is little difference between these snakes and Fukien *chinensis*. Judgment on this matter must await new material.

Stejneger (1925), after discussing the relationship of eastern Chinese and far western *collaris*, concludes, on the basis of a difference in two characters, that eastern and central Chinese examples deserve a subspecific distinction. The present series perhaps weakens his conclusion to some extent but the matter still can stand best as he put it.

1. THE ENTRANCE OF THE LOWER ANTERIOR TEMPORAL INTO THE LIP.—I choose to put it this way and consider this scale a temporal and not a labial. In the present series this occurs only in three specimens out of twenty-seven and then on but one side, so we see that the character really holds good though not without exceptions. Steindachner (1913), however, finds no exception among thirteen Formosan snakes.

2. VENTRAL COUNT.—Stejneger gives the range of Chinese specimens as 178 to 187 ventrals and the western as 159 to 180. Twenty examples from the present series range from 167 to 183 but only two fall below 171 and the average is 178.

The contact of the parietal with the lower postorbital is mentioned by Stejneger. Among the thirty-seven Fukien examples there is contact on both sides in four and on one side in another.

Other characters, though of less importance, may be recorded for twenty specimens out of the entire twenty-seven as follows:

The upper labials are 9-9 in all but three which have 8-8, 8-9, and 9-10. The preoculars are 1-1, the postocular 2-2 and the posterior temporals 2-2. I am considering the anterior temporals to be uniformly 2-2 for I have not counted as labials the three scales that enter the lip margin, but I have counted them as temporals. There are always 17 rows of scales. Unfortunately, only three males have complete tails and their subcaudal counts cover such a range (122, 120, and 109) that it is hard to conclude in regard to the relative number of these plates in the sexes. Eleven females range from 98 to 109 with an average of 107. The tails of these eleven females occupy from 0.30 to 0.33 of the total length, while in three males the tails occupy 0.34, 0.35 and 0.36. The two largest males measure from snout to vent 406 and 395 mm., the largest females 463 and 444 mm., respectively. The variability of the color pattern is striking. The head is always dark with a light patch on either side at the posterior edge of the dark area. From the center of the edge of the dark area a line always runs posteriorly. This line may extend even back on to the tail and often there is an additional line on either side parallel to it. Sometimes the central line barely extends back of the neck and in some specimens this line is present but the parallel lines are not evident. The lines may take the form of rows of dots. In the present series about one-third have three distinct lines and another third only the beginning of the central line, while the rest have combinations of the two extreme colorations. The pair of lateroventral lines is always present.

This most graceful snake is very common in the mountain bamboo groves and forests about Yenping and Kuatun. I often took them as they glided over the shady forest floor and recall seeing as many as three in one day. They did not strike nor bite.

Skink remains were found in the stomachs of three and fragments of some species of *Takydromus* in two others.

Four females contained from two to four eggs each. A fairly well-developed egg measured 33×9.5 mm. On August 22 three white eggs (No. 34539) were brought in at Kautun. Two of them measured 36.5×15 and 34×13.3 mm. respectively, while the third was only 29.5 mm. long. Each contained a fully developed and well-pigmented snake, the longest of which measured 203 mm. from snout to tip of tail. The color pattern is identical in all three. The lines are evident, but faint everywhere except at the beginning of the central one. In the entire series of this species, as borne out by these three as well, there is no correlation between age and color pattern.

NATRIX

Natrix æquifasciata Barbour

Eleven specimens, ten from Futsing Hsien (Nos. 33814-823), and one from Foochow, make up the lot of this species.

Barbour (1908) described this striking snake from Hainan. Stejneger (1925) reports one from Yenping, and Schmidt (1927) records one from Futsing in the former Asiatic Expedition's collection.

The present series shows no marked variations so the counts will be recorded as concisely as possible. The upper labials are 9-9 in all but one in which they are 8-9; the lower are 10-10 in seven, 10-11 in two, 9-10 in one, and 8-9 in one. The preoculars are 1-1 in eight, 1-2 in two, and 2-2 in 1; the postoculars, 3-3 in nine, 2-3 in one, and 2-2 in one. The suboculars are 1-1 in seven, 1-0 in two, 1-2 in one, and entirely lacking in one. There is often doubt as to whether a scale behind and below the eye should be called a post- or subocular. At any rate this character is variable enough to be of little value. The suboculars may be very minute as in No. 35200. The anterior temporals are extremely variable being 2-2 in three, 2-3 in three, 3-3 in two, 3-4 in two, and 2-4 in one; the posterior, a little better with 3-3 in seven, 2-3 in three, and 3-4 in one. The scale formula is invariably 19-19-17.¹ The chinshields and first pair of lower labials are smooth in all six females but rough in three out of five males.

The ventrals in the five males range from 150 to 153 with 151 as average, in the six females from 144 to 148 with 145 as average. This snake very often suffers the loss of the tip of the tail, so the subcaudal counts and measurements are neither complete nor reliable. In three females with tails that appear to be complete the counts are 72, 75, and 76, while the single entire male has 73 subcaudals. The three largest of each sex measure (males) 735, 578, 560, and (females) 1100, 763, 701 mm. from snout to vent. The tail occupies 0.22, 0.23, and 0.24 of the whole in the three entire females and 0.22 in the single male. The anal is divided in all but one example. The large size *æquifasciata* may attain is illustrated by No. 33814, a female 1420 mm. from snout to tip of tail, and 153 mm. around the largest part of the body. This snake, nevertheless, was taken in a small mountain stream.

In strong contrast to *annularis* and *piscator* this species is a true inhabitant of mountain brooks. Even though I caught several and saw many that escaped me I never found one away from a stream. They were found either in the stream or basking on the bushes over the water into

¹Unless stated otherwise such numbers represent counts taken on neck, at midbody, and just before vent.

which they dropped when alarmed. Sometimes they dropped from a point ten or twelve feet above the water. After reaching the water they hid under stones on the bottom. Even though the brooks in which I observed these snakes flowed through flooded fields which, as well as the streams, were frequented by *piscator* and *annularis* I failed to find *æquifasciata* in the fields. This point is repeated for emphasis as it is interesting to note the tenacity with which this snake clings to its original habits.

When annoyed *æquifasciata* gathers itself into irregular coils, often striking violently and hissing at each stroke. It might be called "snappy" or "pugnacious."

A small fish of the genus *Zacco* was found in the Foochow specimen.

The Futsing streams in which *æquifasciata* was so common were the open kind found in hills and low mountains and not the high, shaded cascade type. The snakes were taken at very nearly sea-level and are probably to be reckoned as inhabitants of more gently flowing, open country, rather than heavily shaded, cascading mountain watercourses. This does not mean that they never venture into the latter.

Natrix annularis (Hallowell)

One hundred and four specimens, sixty from Yenping (Nos. 33306-365), twenty-five from Futsing (Nos. 33830-854), four from Ch'ungan Hsien (Nos. 33690-693), and fifteen from Hok'ou, Kiangsi Province (Nos. 35060-074), make up the large series of this species. Schmidt (1927) has already reported on the Expedition's former collection of thirty-two specimens from Anhwei and Fukien Provinces.

This species has now been recorded from central Szechwan (Vogt, 1924), and western Yunnan (Mell, 1922). Wall (1903) says that it is common in the Yangtze Valley, Mell found it so in northern Kwangtung, while Formosan records are numerous (Oshima, 1910; Steindachner, 1913, etc.). It is certainly abundant in Fukien.

The present series agrees well with Schmidt's. It is interesting though to note that the male has more bands than the female. Only two females out of eleven had more than 40 body-bands while none of the thirteen males had less than 40. Only one female out of eight had more than 20 tail-bands while every male had at least 22. A summary follows:

| NUMBER OF BANDS | | | |
|-----------------|---------|------|---------|
| | On Body | | On Tail |
| 13 ♂ | 40-46 | 10 ♂ | 22-27 |
| 11 ♀ | 34-44 | 8 ♀ | 16-22 |

Twenty-four specimens, including some from each locality (Nos. 33306, 33310-11, 33318, 33321-22, 33335, 33339, 33348, 33690-93,

33831-33, 33839, 33841, 33843, 35060, 35066, 35068 and 35073-74), were examined with the following results. The upper labials were 9-9 in fourteen, 8-9 in eight, and 8-8 in two; the lower 10-10 in nineteen, 9-10 in four, and 10-11 in one examples. The preoculars were uniformly one on a side and the postoculars were 3-3 in all but one which had two on each side. The anterior temporals were 3-3 in twelve, 2-2 in seven, 2-3 in four, and 3-4 in one; the posterior, 3-3 in sixteen, 2-3 in seven, and 1-2 in one. The scales were 19-19-17 in all but one which had the formula 19-19-18. The outer row was smooth in all, but the second was faintly keeled in twenty-three out of twenty-five specimens. In the remaining two it was smooth. The three largest females from snout to vent measured 552, 540, 510 mm., the largest males 441, 440, 428 mm., respectively.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 13 | 153-163 | 157 |
| | ♀ | 11 | 145-159 | 151 |
| Caudals | ♂ | 10 | 63- 69 | 66 |
| | ♀ | 8 | 58- 61 | 60 |
| Tail/Total Length | ♂ | 10 | .20-.23 | .21 |
| | ♀ | 7 | .19-.22 | .21 |

Two females contained six, one nine, one five, and one four embryos, in various stages of development.

Five stomachs contained the remains of small loaches, four held remnants of eels of the genus *Fluta*, while in one stomach there were minnows and an eel head (*Fluta*). Frog remains were found in only two snakes. *N. annularis* thus shows a preference for fish over frogs though certainly one class of food is as abundant as the other in the streams and flooded fields frequented by these snakes.

N. annularis is common in Fukien from the coast up to the base of the high Kuatun range. Near Yenping it is extremely abundant even in the upper mountain valleys there. It does not frequent the shaded forest cascades but rather the irrigated fields and streams of the open valleys. It is as abundant in the rice fields as in the stream beds and in this way its habits contrast with those of *N. æquifasciata* which seems to be confined to the latter. I never saw *annularis* drop from a bush into the water but often found it in level, open, highly cultivated rice fields far from shade or streams. Probably it was originally an inhabitant of hilly

country streams and waterways but has now adapted itself to a rice-field life.

N. annularis is replaced in the mountains by *percarinata* from which it may be readily told by the difference in coloration of the throat. In *percarinata* the dark ventral bars fail to meet on the first few dozen ventral plates, while in *annularis* they unite in the midline almost up to the head. This is somewhat a matter of degree but the difference is very constant and is the surest simple way of distinguishing these very similar species.

In disposition it is a typical *Natrix*, most specimens being very vicious and wild.

***Natrix percarinata* (Boulenger)**

One hundred and six specimens, seventy-seven from Ch'ungan Hsien (Nos. 33653-689 and 34383-422), twenty-three from Yenping (Nos. 33366-386 and 35141-142), and six from Futsing (33824-829), make up the lot of this species. In addition there is an embryonic series from Ch'ungan (Nos. 34423-427). Schmidt (1927) has already reported on six specimens from Fukien, Szechwan and Anhwei, the specimen from the last locality having been bought. Boulenger (1899) described this species from a single Kuatun specimen.

Smith (1923) gives his Hainan record; Stejneger (1925) describes specimens from Mt. Omei, Szechwan; and Parker (1925) records Tonkin examples. Thus the known range of *percarinata* is rapidly expanding.

The present series agrees well with former descriptions. Eighteen examples, (Nos. 33367, 33376-78, 33674, 33687, 33824-27, 34383-84, 34387, 34389, 34390, 34395, and 34397-98), some from each locality, have been examined in detail. It is interesting to see that the rugosity on the chin-shields and the first pair of lower labials is a sexual character, all nine of the males examined having it developed to a marked degree while none of the females had it developed to any extent, even though in two, very small pimples could be made out. The upper labials are 9-9 in fifteen, 8-9 in two, and 9-10 in one; the lower, 10-10 in fifteen, and 10-11 in three. There is but one preocular on each side in all eighteen but the postoculars are 4-4 in ten, 4-5 in five, 3-3 in two, and 3-4 in one. The anterior temporals are 3-3 in thirteen, 3-2 in three, and 4-3 in two; the posterior, 3-3 in fourteen, 2-2 in two, 3-2 in one, and 4-3 in one. The scale formula is regularly 19-19-17.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 9 | 139-143 | 140 |
| | ♀ | 9 | 138-142 | 140 |
| Caudals | ♂ | 8 | 70- 79 | 74 |
| | ♀ | 6 | 67- 73 | 70 |
| Tail/Total Length | ♂ | 8 | .23-.27 | .25 |
| | ♀ | 6 | .26-.27 | .26 |

The three largest females measure from snout to vent 730, 645, and 620 mm., the males 567, 524, and 515 mm., respectively.

Seven stomachs held frog, three tadpole, two loach, and one cray-fish remains. In contrast to *annularis* this species seems to be a frog rather than a fish eater.

The number of eggs found in eleven females averaged 7.5 for each and ranged from 4 to 13. On August 31 at Kuatun a man brought in one of these snakes along with 10 white eggs. The snake was very docile and remained by the eggs, not making the invariable wild dash for freedom. It was kept for several days and remained quietly coiled about the eggs which had been placed in a small, dry tin can. Thus the adult clearly and beyond all doubt showed an interest in her eggs even though she would make no attempt to defend them. The eggs were kept until September 12 when they were opened and found to contain well-pigmented embryos, five of which are preserved (Nos. 34223-227). One of these is 170 mm., total length. They are in every way typical *percarinata*.

N. percarinata is an inhabitant of forested mountain streams and cascades. In Futsing it was found at low altitudes in the swift-flowing, clear streams of the low mountains there, but about Kuatun it was really at home. In the few San Chiang rice fields it simply swarmed and could be found most readily at night (Pl. XIX, fig. 1). San Chiang is near Kuatun but at a lower altitude. Unlike *æquifasciata* but like *annularis*, it leaves the streams for shallow water of irrigated fields where its food is undoubtedly abundant. I never found one sunning on a bush over the water like *æquifasciata*. About Yenping *percarinata* was associated with *annularis*, but their ranges scarcely overlap in Ch'ungan Hsien for the high mountains there were not frequented by *annularis*, not a single specimen having been taken in the Kautun region. *N. percarinata* is the forest and mountain form of *annularis*, from which it may be readily distinguished by the difference in color pattern of the throat. This difference is explained under *annularis*.

This snake is very active and has developed to a marked degree the

habit of throwing its body and twisting about violently when annoyed. It often strikes and bites viciously.

***Natrix craspedogaster* (Boulenger)**

Sixty specimens, forty-nine from Ch'ungan Hsien (Nos. 33738-742, 33746-747, and 34542-583), and eleven from Yenping (33392-402), represent this species.

Boulenger described and figured *craspedogaster* in 1899 from six examples secured at Kuatun. Schmidt (1927) reported on four additional specimens, three from Yenping, and one bought in Anhwei Province. Mell (1922) found it in northern Kwangtung. Stanley reported it from Chekiang and Fukien in 1914, and from Fukien again in 1916.

Thirteen Kuatun specimens (Nos. 33738, 33740-741, 34542, 34548, 34551, 34554-555, 34559, and 34565-568) have been found to agree with the original description. The upper labials are 8-8 in ten, and 8-9 in three; the lower, 10-10 in nine, 9-10 in two, 10-11 in one, and 11-11 in one. The preoculars are 1-1 in twelve, and 1-2 in one; the postoculars, 3-3 in eleven, 4-4 in one, and 1-3 in one. In Nos. 33740 and 34542 there are extra minute scales between the postoculars and the temporals. The anterior temporals are 2-2 in nine, 2-3 in two, 3-3 and 3-4 in one each. The scale formula is 19-19-15 in all but one, in which it is 17-19-17, and the anal is always divided.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 7 | 152-157 | 154 |
| | ♀ | 6 | 150-156 | 153 |
| Caudals | ♂ | 5 | 89-100 | 93 |
| | ♀ | 4 | 88-93 | 90 |
| Tail/Total Length | ♂ | 5 | .28-.30 | .292 |
| | ♀ | 4 | .28-.29 | .285 |

Four Yenping specimens (Nos. 33392, 33395, 33400, and 33402) were examined. All have upper labials 8-8, preoculars 1-1, postoculars 3-3, anterior temporals 2-2, and scales 19-19-17. The lower labials are 10-10 in three, and 9-9 in one; the posterior temporals 2-2 in two, 1-2 and 1-1 in one each. The ventrals are 147, 147 in the females, 150, 151 in the males; the subcaudals 83, 87, and ?, 96, respectively. The ventral counts in the sexes differ more markedly here than in the Ch'ungan series.

The three largest males in the entire series of sixty measure from snout to vent 435, 419, and 391 mm., the females, 490, 481, and 478 mm., respectively. The females are decidedly the larger.

One female contained five eggs, two of which measured 28×8.5 and 31×9 mm. Five more were found in each of two other females while two more held seven and nine, respectively. A single large egg measuring 39×9 mm. was seen in still another snake.

Five adults had eaten young frogs or toads, while another had small tadpoles in its stomach, all of uncertain identity.

N. craspedogaster was abundant in the mountains near Yenping and all about Kuatun. It is very docile.

Natrix stolata (Linnaeus)

Seventy-four specimens, forty-three from Futsing Hsien (Nos. 33973-34009 and 34092-097), twenty-eight from Yenping (Nos. 33457-483 and 35146), one from Ch'ungan Hsien (No. 33752), and two from Hok'ou (Nos. 35083-084), represent this species.

Schmidt (1927) reported on one hundred and seven from Hainan, two from Yenping, six from Futsing Hsien, one other from Fukien without specific locality, and one bought in Anhwei. Stanley lists specimens from Fukien (1914 and 1916) and Stejneger (1925) gives Foochow and Yenping records.

The present series shows remarkable agreement with those previously recorded. Twenty-two specimens have been selected for special study (Nos. 33457-458, 33462, 33465, 33469-474, 33476, 33752, 33975, 33994, 33999, 34002, 34005, 34478-479, 35083-084, and 35146). The upper labials are 8-8 in all but two, in one of which they are 8-9, and in the other 7-8; the lower are 10-10 in thirteen, 10-11 in five, 9-10 in two, and 9-9 in two. The preoculars are 1-1 in all; the postoculars, 3-3 in all but two in which they are 3-4. The anterior temporals are 1-1 in twenty-one and 1-2 in one, the posterior, 2-2 in twenty-one and 2-3 in one. The uniform scale formula in 19-19-17, and the anal is always divided.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 12 | 145-156 | 151 |
| | ♀ | 10 | 149-157 | 152 |
| Caudals | ♂ | 11 | 69-81 | 77 |
| | ♀ | 6 | 67-74 | 71 |
| Tail/Total Length | ♂ | 11 | .24-.26 | .258 |
| | ♀ | 6 | .24-.25 | .243 |

The three largest males in the entire lot of seventy-four measure from snout to vent 420, 413, and 410 mm., respectively; the largest

females 499, 485, and 478. In Schmidt's Hainan series the largest specimen was also a female.

Six females contained twelve, ten, nine, eight, six, and five eggs, respectively. One of these eggs measured 22×8 , and another 22×9 mm.

Frog remains were found in three stomachs. Schmidt's Hainan series contained nothing but frog remains also.

Near Yenping *stolata* was frequently seen along open mountain roads about dusk. When surprised it makes a dash for safety which often rattles the dry leaves or grass in which it is hiding. This habit is not shared by other snakes of the region and I could tell that one of these snakes had been started before even seeing it. It is a *Natrix* that to a large degree has given up its semi-aquatic habits and in this respect brings the American garter-snake (*Thamnophis*) to mind. Schmidt (1927) has quoted me to the effect that *stolata* neither strikes nor bites.

It does not range into the Kuatun mountain forests but is found on the plateaus flanking that region. The large series secured testify to its abundance.

***Natrix piscator* (Schlegel)**

Ninety-four specimens, eighty-two from Futsing Hsien (Nos. 34010-091), four from Yenping (Nos. 33484-487), one from 'Ch'ungan Hsien (No. 34657), four from Hok'ou (Nos. 35076-079), and three from Yuan Kiang, Yunnan Province (Nos. 35232-234), represent this species. The Yunnan examples were collected by Walter Granger.

Schmidt (1927) reported on one hundred and ten specimens from Hainan, and three from Futsing Hsien. Boulenger (1899) recorded one Kuatun *piscator*. Stanley, in 1914, listed "numerous examples from Chekiang and Fukien" and in 1916, one from Foochow. Stejneger (1925) records Futsing, Foochow, and Kuliang specimens. Other records are numerous.

Among the entire series seven specimens (Nos. 34010-016) have a varying degree of red on the first few rows of scales but in No. 34017 red is the predominant color, even the mid-dorsal scales and ventral plates having traces of it while the sides are distinctly red. In other respects these specimens agree with the rest in which there is no trustworthy variation.

Seventeen specimens from Fukien and Kiangsi (Nos. 33484, 33487, 34017, 34033, 34050, 34059, 34061, 34064, 34073, 34075, 34079, 34083, 34657, 35076-079) have been closely examined. The upper labials are 9-9 in thirteen, 8-9 in two, 9-10 in one, and 8-8 in one; the lower, 10-10 in eleven, 10-11 in three, and 9-10 in three. The preoculars are always

one on a side, the postoculars 3-3 in thirteen, 3-4 in two, 2-3 and 4-4 in one each. There is a subocular on one side in No. 34017, the red example. The anterior temporals are 2-2 in thirteen, 2-3 in two, 1-1 in one, and split up into four small scales on one side and six on the other in No. 35077. The posterior temporals are 2-2 in fifteen, and 2-3 in two. The scale formula is 19-19-17 in all seventeen.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 7 | 127-135 | 130.7 |
| | ♀ | 10 | 138-155 | 144.2 |
| Caudals | ♂ | 7 | 78-83 | 80 |
| | ♀ | 7 | 68-74 | 70 |
| Tail/Total Length | ♂ | 7 | .30-.32 | .310 |
| | ♀ | 7 | .24-.26 | .248 |

Schmidt's Hainan series averages fewer ventrals, 126.5 for the males, and 138.2 for the females.

The Yuan Kiang specimens have the upper labials 9-9, the lower, 9-10 in two and 9-? in a damaged one; the preoculars 1-1, the postoculars 3-3 in two, and 3-4 in one; the anterior and posterior temporals 2-2, and the scale formula 19-19-17. The ventrals are 140, 141 in the two females, and 130 in the male. Two of three tails are imperfect but the caudals in the single good one, a female, number seventy-four, the tail occupying 0.27 of the total length.

In the entire series there are but twenty-two males, the three largest of which measure from snout to vent 480, 431, and 419 mm., while the three largest females among 72 measure 738, 680, and 655 mm., respectively. The largest snake in the Hainan series was also a female.

One female contained forty-two, another twenty, and another fourteen eggs. One well-developed egg measured 21×11 mm.

A *Barbus snyderi* was found in the stomach of one, a Rhodein carp in another, and unidentifiable fish remains in six others. Three of the snakes had eaten amphibians, one a toad (*Bufo*) and the other two, *Rana limnocharis*. Only one of twelve full stomachs in the Hainan series held fish remains, while here we have seven with fish and only three with amphibian remains.

This snake was extremely abundant in the irrigated fields of Fut-sing Hsien. It frequented the wet and moist grassy banks and terraces of these fields in the open country. In the mountains near Yenping it was relatively rare. The Ch'ungan example was taken on the plateau near Ch'ungan City. Boulenger's Kuatun record is doubtful, for we saw

no trace of it there. Very possibly it was brought into the mountains by a passing traveler.

N. piscator often bites and strikes when handled freely but when surprised always prefers flight.

***Natrix tigrina lateralis* (Berthold)**

Twenty-three specimens, nine from Ch'ungan Hsien (Nos. 33639-640, and 34356-362), eight from the Western Hills, Peking (Nos. 29386-387, 29471-475, 29504), and six from the Tsinan region, Shantung Province (Nos. 29696, 29698-700, 29719, and 29721), represent this species.

Boulenger (1899) lists a specimen from Kuatun, and Stanley (1914) reported it from Fukien.

The present series conforms well with Schmidt's (1927) lot of fifty-two from Chihli, Shansi, Shensi, and Anhwei. All but one have 7 upper labials on both sides. That one has 8 on one side. The lower labials are 9-9 in eleven, 9-10 in six, 8-9 in three, 10-10 in two, and 8-10 in one. The preoculars are uniformly 2-2; the postoculars, 3-3 in thirteen, 3-4 in six, and 4-4 in four. These scales are 3-3 in all but one from Ch'ungan and in that one they are 3-4. The anterior temporals are 1-1 in all, the posterior, 2-2 in all but No. 29474 in which they are 2-3. The scale formula is uniformly 19-19-17 in all but No. 33640 in which it is 19-19-15, and the anal is always divided. The three largest males measure from snout to vent 730, 630, and 609 mm., but the largest from Ch'ungan is only 487 mm. long. The three largest females measure 780, 730, and 730 mm., respectively, but the largest from Ch'ungan measures only 720 mm. Thus the northern specimens are the larger.

Summary of Counts and Measurements

| | SEX | No. of SPECIMENS | EXTREMES | AVERAGES |
|----------------------------|-----|---------------------|----------|----------|
| Chihli and Shantung Series | | | | |
| Ventrals | ♂ | 8 | 148-160 | 155 |
| | ♀ | 6 | 153-162 | 160 |
| Caudals | ♂ | 8 | 60-67 | 64 |
| | ♀ | 5 | 52-56 | 54 |
| Tail/Total Length | ♂ | 8 | .20-.22 | .21 |
| | ♀ | 5 | .17-.18 | .174 |
| Ch'ungan Hsien Series | | | | |
| Ventrals | ♂ | 6 | 148-155 | 152 |
| | ♀ | 3 | 154-157 | 155 |
| Caudals | ♂ | 6 | 57-73 | 64 |
| | ♀ | 2 | 56-65 | 60 |
| Tail/Total Length | ♂ | 6 | .21-.25 | .225 |
| | ♀ | 2 | | .20 |

The belly in Nos. 29471, 29474, and 34359 is uniformly colored, lacking entirely the median black area. This is an approach to *subminiata* and *helleri*.

One Ch'ungan snake contained nine eggs, another five, one of the five measuring 32×12 mm. Frog remains were found in two stomachs.

It is extremely interesting to note the proximity of the ranges of this species and *helleri* in northern Fukien. I was not fortunate enough to secure any of the latter at Yenping, but Mr. Caldwell did so (Schmidt, 1927). At Kuatun, *tigrina lateralis* was not common.

Natrix septemlineata Schmidt

One specimen of this species (No. 35210) described only in 1925, was taken at Hsin Kai, central Yunnan Province, by Walter Granger.

There are 8 upper, and 10 lower labials; 1 preocular and 3 postoculars on a side. The anterior as well as posterior temporals are single. The scales are 19-19-17. There are 162 ventrals and 73 caudals. The snake measures from snout to vent 428 mm.; its tail 141 mm. The tail is 0.25 of the total and the anal is divided. Thus, we see that it agrees in general with the type specimen, though the caudal count is a little low. The dorsal color encroaches on the ventrals more than in the type, while all the upper and two or three anterior lower labials are margined with black.

A small *Rana* was found in the stomach of this specimen.

Natrix helleri Schmidt

Walter Granger collected at Wuting Hsien, northwest Yunnan Province, one specimen (No. 35238) that represents this species described by Schmidt in 1927. Harry R. Caldwell collected a specimen at Yenping where it probably is not common since I failed to secure it there. It is closely allied to *subminiata* of Java and southeastern Asia.

No. 35238 has 8 upper and 10 lower labials on each side; preoculars 1-1, postoculars 3-3; anterior temporals 3-3, two of which on either side are very small; posterior temporals 2-3. There are 18 rows of scales on the neck, 19 at midbody, and 17 before the anus. The ventrals are 170, the subcaudals 88, and the tail .27 of the total length.

The type of *helleri* has 22 rows of scales on the neck, or four more than the new specimen. However, I have compared these two snakes closely and find that the actual difference is slight for if the count is taken a little farther back on the type, it too has but 18 rows. The extra rows on its neck are very short.

The stomach of No. 35238 held frog remains.

PSEUDOXENODON

The Chinese species of this genus have been badly confused for several reasons. First, the material has been scanty, and the descriptions all too brief; secondly, the species have much the same color pattern and scale characters; thirdly, there is often a change in pattern during ontogeny.

For example, Steindachner (1914) had fifteen specimens from Formosa which he called *macrops* yet his Plate III clearly shows that he had examples with a lineate tail which of course must belong to the *dorsalis-striaticaudatus* group. He writes that the majority of his specimens have the caudal stripes, yet the high range of ventrals and caudals given by him exclude not only the two species of the group just mentioned, but all the other eastern Chinese species as well. A single specimen recognized by him as distinct is figured and described as "*macrops* var. *sauteri*." It lacks the tail stripe and its ventral and caudal counts are also so high that it cannot be any of the new Fukien species. Now, I have shown that among the fifteen, the majority with the tail stripes and the single specimen of *sauteri* can be allocated only in a general way. The remaining few with their high ventral and caudal counts are probably allied to *karlschmidti* since the descriptions and figures fail to indicate such a contrasted pattern, especially of the head, as found in *fukienensis*.

It is unfortunate that Indian and western Chinese *macrops* have been confused with the eastern forms, not only by Steindachner but by Mell (1922), Werner (1909), and Stanley (1914, 1916) as well. *P. macrops* and *sinensis* form a group in the southwest with a distinct habitus and pattern. The shape of the head especially is noticeably different.

Barbour's *P. stejnegeri* (1909) is probably represented in Steindachner's series and, for the present, in default of adequate descriptions, the series described by Steindachner with a lineate tail may be called *stejnegeri* and considered to be the insular form of the *striaticaudatus-dorsalis* group.

The *macrops-sinensis* group comes into this paper only by virtue of its relationship with the eastern forms and the single specimen of *sinensis* collected by Walter Granger in Yunnan. Stejneger (1925) finds difficulty in separating the two and, as I have seen no Indian specimens, I am not in a position to carry the matter as far as he has. However, judging by the two Chinese specimens of *macrops*, and the large series of *sinensis* that I have examined, I conclude that the two forms are amply distinct in coloration and barely intergrade in ventral and caudal counts.

Summary of Characters for Species of *Pseudoxenodon* in the American Museum Collection

| SPECIES | LABIALS | | | | OCULARS | | TEMPORALS | | SCALES ¹ | | VENTRALS | | CAUDALS | | MAXIMUM LENGTH SNOUT TO VENT | | DORSAL SPOTS OR BANDS | | TAIL/TOTAL LENGTH | |
|----------------------------------|-----------------------------------|--|--|--|-----------------------------------|----------------------------------|-----------------------|-----------------------|--|--|---|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------|--|---------------------|--|---------------------------------|
| | Upper | Lower | Entering Eye | Contact First Pair Chin- Shields | Pre- | Post- | Anterior | Posterior | Number of Rows | Rows not keeled at Midbody | Extremes and Averages ♂ ♀ | Extremes and Averages ♂ ♀ | Extremes and Averages ♂ ♀ | Extremes and Averages ♂ ♀ | Millimeters ♂ ♀ | ♂ ♀ | Body | Tail | Extremes and Averages ♂ ♀ | Extremes and Averages ♂ ♀ |
| <i>Pseudoxenodon</i> | | | | | | | | | | | | | | | | | | | | |
| <i>tambusiicola</i> 5♂ 5♀ | 8-8 | 10-10 in 5 9-10 in 3 9-9 in 1 ?-? in 1 | 4, 5 1, 5 in 9 ?-? in 1 | 5-5 in 5 4-4 in 1 4-5 in 3 ?-? in 1 | 1 1 in 10 | 3-3 in 8 2-2 in 1 2-3 in 1 | 2-2 in 9 1-1 in 1 | 2 2 in 9 1-1 in 1 | 19-17-15 in 9 17-17-15 in 1 | 1-1 in 8 ?-? in 2 | mainland 4♂ 131-133, 132 Hainan 1♂ 140 | 139-142, 141 | 50-52 51 | 42-46 44 | 516 Hainan Example | 530 Futsing Example | Range of Total Number of Dorsal Cross-bands 19-23 in 8 | | 18-19 in 4 16 in Hainan Specimen | 15-15 |
| <i>subcaudatus</i> 9♂ 12♀ | 8-8 in 15 7-7 in 4 7-8 in 2 | 9-9 in 18 9-10 in 3 | 4, 5 1, 5 in 15 3, 4-3, 4 in 4 4, 5-3, 4 in 2 | 4 4 in 20 4-5 in 1 | 1 1 in 18 2-2 in 2 1-2 in 1 | 3 3 in 20 3-4 in 1 | 2 2 in 19 1-2 in 2 | 2 2 in 18 1-2 in 3 | 19-17-15 in 10 17-17-15 in 1 18-17-15 in 1 | ♂ 1-1 in 9 ♀ 2-2 in 7 3-3 in 3 1-1 in 1 2-3 in 1 | 140-144, 142 | 146-153, 149 | 8♂ 59-64, 61 | 11♀ 52-62, 57 | 676 | 635 | Anteriorly, Spots Indistinct, Striped Posteriorly | | 8♂ .20-.22 .207 | 11♀ .17-.20 .185 |
| <i>fuhsienensis</i> 12♂ 3♀ | 8-8 in 14 7-8 in 1 | 8-9 in 9 7-8 in 3 8-9 in 2 7-7 in 1 | 4, 5-4, 5 in 13 3, 4-4, 5 in 1 4-4 in 1 | 4-4 | 1-1 | 3-3 in 14 4-4 in 1 | 2-2 | 2-2 in 12 2-3 in 3 | 19-17-15 | 1-1 in 10 0-0 in 5 | 137-143, 140 | 147-148 | 61-65 63 | 54-57 56 | 493 | 535 | 25-29 | 13-16 | .21-.24 .23 | .18-.19 |
| <i>kuichakmidti</i> 4♂ 4♀ | 8-8 in 7 7-8 in 1 | 9-10 in 4 9-9 in 1 8-10 in 1 10-10 in 1 ?-? in 1 | 4, 5-4, 5 in 6 3, 4-4, 5 in 1 ?-? in 1 | 4 5 in 5 5-5 in 1 4-4 in 1 ?-? in 1 | 1-1 | 3-3 in 7 ?-? in 1 | 2-2 | 2-2 in 6 2-3 in 2 | 19-17-15 | 1-1 | 144-151, 148 | 149-154, 152 | 58-60, 59 | 51-56, 55 | 625 | 653 | 20-24 | 8-10 in 7 ? in 1 | .18-.19 | .17-.18 |
| <i>sinensis</i> 8♂ 14♀ | 7-7 in 21 7-8 in 1 | Combinations of 8 and 9 | | | 1-1 | 3-3 | 2-2 | | 19-19-15 | | 138-146, 144 | 149-162, 155 | 60-68, 62 | 57-66, 61 | | | | | .18-.22 .20 | .19-.20 .19 |
| <i>macrops</i> 1♂ 1♀ | 7-7 | 8-8 | | | 1-1 | 3-3 in 1 2-3 in 1 | 2-2 | 2-2 in 1 2-3 in 1 | 17-19-15 in 1 19-19-15 in 1 | | 154 | 164 | 71 | 67 | 540 | 296 | | | .23 | .20 |

¹Scale counts made just posterior to head, at midbody and before vent.

This genus turns out to be most interesting. It is evidently speciating very rapidly, hence the large number of related forms in isolated mountain groups. The pattern is fundamentally the same but varies as the different color elements are pronounced or subdued. General descriptions are of little value. The habits, especially the actions when alarmed, should be carefully observed and compared. At least two of the three new forms flatten the neck when annoyed and I have gone into detail concerning the behavior of *bambusicola*. Probably there are many undiscovered forms in various parts of China and unless these are described with great care as they come to light the confusion already so bad will become even worse.

The validity of the three new species described herein might be questioned but, for the following reasons, I am convinced that they are perfectly distinct.

- (1) There is no sign of intergradation among them.
- (2) All are represented by adequate series.
- (3) The number of specimens in the series is relatively equal.
- (4) The ontogeny of the color pattern is known in each case.
- (5) Field observations indicate distributional and habitat differences.

The folding table summarizes the data of special diagnostic value for the species in the American Museum's collection.

***Pseudoxenodon bambusicola* Vogt**

Eight examples, six from Yenping (Nos. 33405-409, and 35143), and two from Futsing Hsien (Nos. 34098-099), make up the series of this species.

Vogt (1922) described two new species from Mell's Kwangtung collection. These he called *melli* and *bambusicola*. Werner (1926) has shown these to be male and female of one species, *bambusicola*. Schmidt (1927) described a specimen that I collected on Hainan and another bought at Wuhu, Anhwei Province. Smith (1923) also secured a specimen on Hainan.

In all eight examples the fourth and fifth labials enter the eye. Five lower labials are in contact with the first pair of chin-shields in five specimens, 4 on one side, 5 on the other in three, while in a single one there are but 4 on a side in contact with them. All but the first row of scales on either side are keeled in seven, but in No. 34099 the first two are smooth. This specimen fails to conform in other respects. Seven anals are divided, one undeterminable. The following tables give the important characters for the Anhwei and Hainan specimens, as well as for the eight from Fukien.

MALES

| | Fukien | Fukien | Fukien | Anhwei | Hainan |
|---------------------|----------|----------|----------|----------|----------|
| A. M. N. H. Nos. | 33405 | 33409 | 35143 | 23527 | 27753 |
| Dorsal scales | 19-17-15 | 19-17-15 | 19-17-15 | 19-17-15 | 19-17-15 |
| Ventrals | 131 | 131 | 133 | 131 | 140 |
| Subcaudals | 50 | 52 | 50 | 51 | 52 |
| Upper Labials | 8-8 | 8-8 | 8-8 | 8-8 | 8-8 |
| Lower Labials | 10-10 | 9-10 | 9-10 | 9-9 | |
| Preoculars | 1-1 | 1-1 | 1-1 | 1-1 | 1-1 |
| Postoculars | 3-3 | 3-3 | 3-3 | 2-2 | 3-3 |
| Anterior Temporals | 2-2 | 2-2 | 2-2 | 2-2 | 2-2 |
| Posterior Temporals | 2-2 | 2-2 | 2-2 | 2-2 | 2-2 |
| Dorsal Cross-bands | 14 | 16 | 16 | | |
| Total Length | 413 | 276 | 418 | 339 | 618 |
| Tail/Total Length | .18 | .18 | .19 | .18 | .16 |

FEMALE

| | Fukien | Fukien | Fukien | Fukien | Fukien |
|---------------------|----------|----------|----------|----------|----------|
| A. M. N. H. Nos. | 33406 | 33407 | 33408 | 34098 | 34099 |
| Dorsal Scales | 19-17-15 | 19-17-15 | 19-17-15 | 19-17-15 | 17-17-13 |
| Ventrals | 142 | 139 | 142 | 142 | 140 |
| Subcaudals | 44 | 45 | 45 | 46 | 42 |
| Upper Labials | 8-8 | 8-8 | 8-8 | 8-8 | 8-8 |
| Lower Labials | 10-10 | 10-10 | 10-10 | 10-10 | 9-10 |
| Preoculars | 1-1 | 1-1 | 1-1 | 1-1 | 1-1 |
| Postoculars | 3-3 | 3-3 | 3-3 | 3-3 | 2-3 |
| Anterior Temporals | 2-2 | 2-2 | 2-2 | 2-2 | 1-1 |
| Posterior Temporals | 2-2 | 2-2 | 2-2 | 2-2 | 1-1 |
| Dorsal Cross-bands | 23 | 20 | 14 | 19 | 16 |
| Total Length | 378 | 398 | 311 | 624 | 174 |
| Tail/Total Length | .15 | .15 | .15 | .15 | .15 |

The dorsal band count does not include any part of the pattern on the neck. All but one, two or three of the upper labial sutures are black. In color the sexes differ only in intensity of pattern, the male coloration being less vivid than the female. This is due to the slight intermixture of ground color with the dark cross-bands on the back in the male. The conspicuous head pattern is also more vivid in the female. I fail to detect all of the sexual color differences described by Werner (1926).

It is significant that this species was not found in the Kuatun mountains though it was common enough around Yenping. It probably does not reach central China but is widely distributed in the southeast, thus avoiding conflict with other species of the genus.

In handling four of these snakes I detected the following behavior: flattening of neck and part of body; inflation of same; opening of mouth

half-way; drawing up or curling of lips; vibrating tail; and an apparent simulation of death by turning on back and lying motionless for some minutes. Only one specimen showed this last behavior but it "played possum" repeatedly. However, when turned on its belly it would not immediately reverse itself as some examples of the genus *Heterodon* will do. Two specimens curled the lips upward but only one vibrated the tail. None could actually be made to bite in spite of the threatening attitude, with mouth partly open.

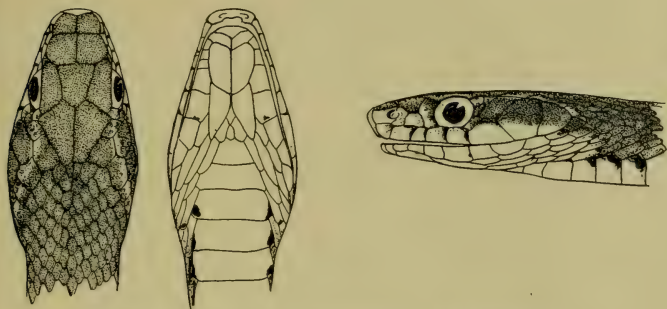


Fig. 3. *Pseudoxenodon striaticaudatus*, new subspecies.
Dorsal, ventral, and lateral views of head of type, twice natural size.

***Pseudoxenodon striaticaudatus*, new species**

Figures 3 and 4

TYPE.—A. M. N. H. No. 33759, ♀; Ch'ungan Hsien, northwest Fukien Province, China; June-July, 1925; Clifford H. Pope.

DIAGNOSIS.—A *Pseudoxenodon* differing from its ally, *dorsalis*, in having a higher; ventral and subcaudal count, and in lacking all traces of yellow or red in its coloration.

DESCRIPTION OF TYPE.—Rostral much broader than deep, just visible from above, internasals slightly shorter than prefrontals; frontal longer than broad, as long as its distance from rostral, shorter than parietals which are twice as broad in front as behind. Loreal deeper than long; preoculars 1-1; postoculars 3-3; both anterior and posterior temporals 2-2. Upper labials 8-8, fourth and fifth entering eye; lower labials 9-10, four in contact with anterior chin-shields on one side, five on the other. The maximum number of scale-rows is 19, the minimum 15, the reduction to 17 taking place opposite the nineteenth ventral plate, that to 15 on either side of the seventy-first; at midbody, all but three rows on either side feebly keeled. Ventrals 148; anal divided; suboculars 55. Total length, 776 mm.; tail, 0.18 of total.

The dorsum is an obscure, intricate mixture of black and gray, blending on the neck to give a uniformly dark appearance but arranged along the midregion to form indistinct, black-bordered, diamond-shaped spots reaching to the second scale-row on either side. Most of the scales not entering this pattern are gray, many others are gray but bordered with black, while a few are entirely black. From a point a tail's length anterior to the anus a black-bordered mid-dorsal, light gray stripe extends to the tip of the tail. This is the most conspicuous marking on the dorsum. The light ventrum is profusely spotted with black. The spots run together laterally to form a black band and centrally are most numerous along the anterior edge of each plate. The spots are varied in size and shape and hazy in outline. They are present only on the tips of the first few ventrals.

There is a dark line from behind the eye to the angle of the mouth, while all but the last two upper labials are black-bordered posteriorly. The ventral surface of the head is milky white.

DESCRIPTION OF PARATYPES.—All of the twenty paratypes (Nos. 33760-762, 34596, and 34662-677) come from the type locality.

The upper labials are 8-8 in fourteen, 7-7 in four, 7-8 in two, with the fourth and fifth entering the eye in fourteen, the third and fourth in four, while in two the third and fourth enter on one side, the fourth and fifth on the other. The lower are 9-9 in eighteen, and 9-10 in two, with the first four touching the anterior chin-shields in all. The preoculars are 1-1 in seventeen, 2-2 in two, and 1-2 in one; the post-oculars 3-3 in nineteen, 3-4 in one; the anterior temporals 2-2 in eighteen, 1-2 in two; the posterior 2-2 in seventeen, 1-2 in three. In ten specimens the scales are in 17 rows on the neck, while in nine more they are in 19 rows there. A single example has them in eighteen. At midbody there are uniformly 17 rows, before the anus always 15. All but the first row of scales on either side are keeled at midbody in the nine males, while among the eleven females all but the first two rows are keeled in seven, the first three in two, the first in one, the first two on one side, the first three on the other, in the last. The anal and subcaudals are always divided. The three largest males measure 676, 625, and 620 mm., from snout to vent, the largest females 614, 571, and 550 mm., respectively.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 9 | 140-144 | 142 |
| | ♀ | 11 | 146-153 | 149 |
| Caudals | ♂ | 8 | 59-64 | 61 |
| | ♀ | 10 | 52-62 | 57 |
| Tail/Total Length | ♂ | 8 | .20-.22 | .207 |
| | ♀ | 10 | .17-.20 | .185 |

The color in the adults is fairly uniform. The black-edged, mid-dorsal, light stripe being one to two tail-lengths anterior to the anus, rarely only half a tail-length before it. There is a conspicuous black band from the eye to the angle of the mouth in all but one. The speckling on the belly varies in intensity, being profuse in two and sparse in four. Anteriorly the ventrum of twelve specimens is crossed by brown bars

each covering all or part of a plate. These bars are most evident in the largest specimens and absent in the smallest. The color pattern is vivid in the juveniles but essentially the same as in the adult, the difference being in the much greater intensity of the black parts of the pattern in the young. In the adult there is a strong tendency for the darker blotches to blend with the gray ground color, each scale losing much of its black. The contrast is greatest on the neck where the young are vividly barred, the adult almost uniformly gray. There is a faint, reddish interocular bar in the smallest examples. Only the upper labial sutures below and anterior to the eye are black, there being less black on the lip in this species than in *karlschmidtii*. By far the greatest amount of labial black for the Fukien *Pseudoxenodons* is found in *fukienensis*.



Fig. 4. *Pseudoxenodon striaticaudatus*, new species.

Head and neck pattern of juvenile paratype, A. M. N. H. No. 34670, four times natural size.

The type of *dorsalis*, a female, has but 140 ventrals, or six less than any in the series of eleven female *striaticaudatus*, while the number of subcaudals in the type, 51, falls below the lower extreme of ten specimens of the new species. Furthermore, the color of *dorsalis* is clearly unlike that of *striaticaudatus*, for the latter has no sign of red or yellow in its pattern, nor has the adult a blackish band on the nape. Stejneger's supposition that the type locality of *dorsalis* is really Hupeh Province is strengthened by the evident difference between the type and the new Fukien *striaticaudatus*.

Werner (1909) records two specimens of *dorsalis*, one from Canton, and one without definite locality. The former, a male, agrees fairly well with *striaticaudatus* in having 43 ventrals and 58 subcaudals, but disagrees in having only 2 postoculars. None of the twenty-one *striaticaudatus* has less than 3 postoculars on either side. Mell (1922) does not record *dorsalis* from the Canton region. This specimen of Werner's is very puzzling and cannot be satisfactorily allocated. Werner's other example, also a male, disagrees markedly with *striaticaudatus* in having but 131 ventrals and 52 subcaudals. The description, however, matches that of *dorsalis* quite well and its identification may be taken as correct for the present.

***Pseudoxenodon fukienensis*, new species**

Figure 5

TYPE.—A. M. N. H. No. 34650; ♂; Ch'ungan Hsien, northwest Fukien Province, China; April-September, 1926; Clifford H. Pope.

DIAGNOSIS.—A small *Pseudoxenodon* without a caudal stripe but with a vivid

head and body pattern persistent throughout life. The ventral count is low, the caudal high, and as might be expected, the tail proportionately long. Lower labials only 8-8.

DESCRIPTION OF TYPE.—Rostral broader than deep, just visible from above; internasals shorter than prefrontals; frontal much longer than broad, as long as its distance from end of snout, slightly shorter than parietals, which are as long as their distance from internasals. Loreal deeper than long: preoculars 1-1; postoculars 3-3; both anterior and posterior temporals 2-2; upper labials 8-8, fourth and fifth entering eye; lower labials also 8-8, four pairs in contact with anterior chin-shields. Scale formula 19-17-15, the reduction from nineteen to fifteen taking place so abruptly at midbody that the section covered by seventeen rows is equal only to width of some twenty ventral plates; at midbody all scale-rows keeled. Ventrals 138; anal divided; subcaudals 62; total length 616 mm., 0.22 occupied by tail.

Fundamentally the dorsal color pattern is strikingly like that of the other *Pseudoxenodons*, but actually it is distinct because of the different values of the component parts. The rather faint, mid-dorsal light spots, 36 in number, are black-bordered before and behind, and from side to side cover three or four scale-widths, while longi-

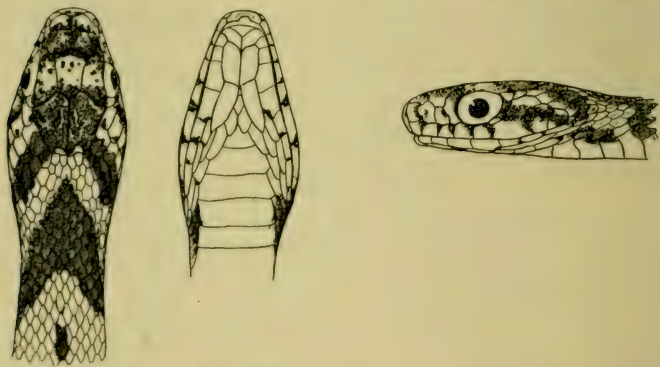


Fig. 5. *Pseudoxenodon fukienensis*, new species.

Dorsal, ventral, and lateral views of head of type, twice natural size.

tudinally they cover the length of a scale. The lateral black spots fall opposite the central light ones and are about twice as large. There is a purplish tinge to the ground color along the sides that is lacking down the middle of the back. On the tail only the light spots, 15 in number, predominate, for there the rest of the pattern is obscure.

The ventrum has the usual dark speckling which is almost lacking on the first score of ventral plates just as in the other species. The speckling is proportionately less concentrated laterally, but the individual spots tend to run together along the base of each plate, and, posteriorly, across the center. The greatest profusion of speckles is reached before the anus, for behind it they are only moderately profuse and almost lacking along the juncture of the divided subcaudal plates.

The top of the head is black except for a gray interocular band and a gray temporal stripe irregular in outline extending from the eye to a little above the angle of the mouth. The side of the head between the eye and nasal opening is also gray as is the rostral plate. At the suture between each of the first five upper labials is a wedge-shaped, black spot directed downward. A postocular stripe, just below the temporal one described above, borders the sixth and crosses the last two upper labials, sending a point downward at the suture between the sixth and seventh. There is a very conspicuous V-shaped, black band across the neck whose apex reaches almost to the parietals.

DESCRIPTION OF PARATYPES.—All of the fourteen paratypes (Nos. 33749, 34642-649, 34651-655) are from the type locality.

The upper labials are 8-8 in thirteen, 7-8 in one; the lower, 8-8 in eight, 7-8 in three, 8-9 in two, and 7-7 in one; the preoculars are uniformly 1-1; the postoculars 3-3 in thirteen, 4-4 in one; anterior temporals 2-2 in all; posterior, 2-2 in eleven, 2-3 in three. The scales are always in 19 rows on the neck, 17 at midbody, and 15 before the anus. At midbody all the rows are keeled in four specimens, all but one in ten. The anals are divided and the subcaudals are in two rows. The fourth and fifth labials enter the eye on both sides in twelve, the third and fourth on one side, fourth and fifth on other in one, while only the fourth enters on both in No. 33749. There are always four lower labials in contact with the anterior pair of chin-shields. The three largest males measure 493, 480, 457 mm. from snout to vent, the only three females 535, 502, and 182 mm., respectively.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 11 | 137-143 | 140 |
| | ♀ | 3 | 147-148 | 147 |
| Caudals | ♂ | 11 | 61-65 | 63 |
| | ♀ | 3 | 54-57 | 56 |
| Tail/Total Length | ♂ | 11 | .21-.24 | .236 |
| | ♀ | 3 | .18-.19 | .186 |

The mid-dorsal light spots are 27 in six, 20 in five, 26, 28, and 29 in one each; the caudal 14 in five, 15 in four, 13 and 16 in two each, 11 in one. Anteriorly they are rather indistinct. The belly is more profusely spotted posteriorly than anteriorly and the spots blend along the ends of the plates. In a few specimens the spots are not profuse anteriorly. The pattern remains strong even in the largest specimens, the head markings being especially noticeable. The interocular, light gray band is always prominent and all the upper labial sutures are conspicuously black. In the very small specimens, the pattern is strongest and very clear, but in every particular like that of the adult.

When annoyed this species flattens its neck threateningly but makes only feeble attempts to bite. It is not rare in the forests about Kuatun. Frog remains were found in one stomach. One female held three well-developed eggs, one of which measured 47×13 mm.

This snake need not be confused with *karlschmidtii* because that species has decidedly fewer spots on the dorsum, a less vivid dorsal pattern, and a uniformly colored head that contrasts strongly with the conspicuously banded head of *fukienensis*. There are many other differences as well.

***Pseudoxenodon karlschmidtii*,¹ new species**

Figures 6 and 7

TYPE.—A. M. N. H. No. 34658; ♀; Ch'ungan Hsien, northwest Fukien Province, China; April–September, 1926; Clifford H. Pope.

DIAGNOSIS.—A *Pseudoxenodon* allied to *sinensis* from which it differs through a lack of yellow in the dorsal pattern, in having a narrower head, higher labial count, more ventrals in the males, fewer in the females, and fewer subcaudals in both sexes. Moreover, *karlschmidtii* undergoes a more marked color change during ontogeny.

DESCRIPTION OF TYPE.—Rostral broader than deep, just visible from above; internasals much shorter than prefrontals; frontal much longer than broad, barely as long as its distance from end of snout, just as long as parietals, which are much less than twice as broad in front as behind. Loreal deeper than long; preoculars 1–1; postoculars 3–3; anterior temporals 2–2; posterior, 2–3. Upper labials 8–8, fourth and fifth entering orbit; lower labials 9–10, four in contact with anterior chin-shields on one side, five on other. Scales reduced from maximum of 19 to minimum of 15 at

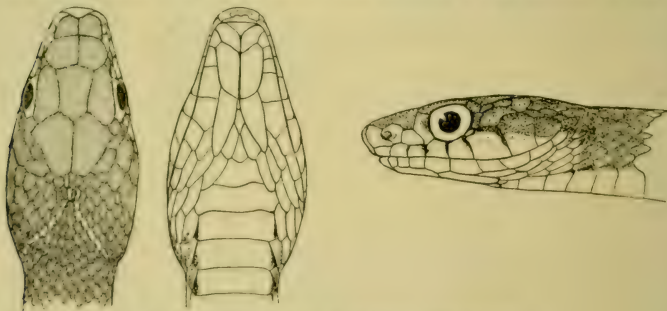


Fig. 6. *Pseudoxenodon karlschmidtii*, new species.

Dorsal, ventral, and lateral views of head of type, twice natural size.

midbody, consequently count of 17 extends along a distance equal to width of only some six ventrals. Ventrals 154; anal divided; subcaudals 56; total length 796 mm., 0.18 taken up by tail.

The ground color of the dorsum is blackish gray. Down the middle of the back are 24 light gray spots. From side to side each spot covers the width of four to six scales but longitudinally only the length of one. Some of these spots lie obliquely and

¹Named for Mr. Karl P. Schmidt who has already reported the former Asiatic collections of the American Museum.

all are surrounded by scales, part black and part gray. Anteriorly on either side is a very indistinct row of darkish spots made up of black-bordered scales. These darkish spots for the most part alternate with the mid-dorsal spots. The majority of the dorsal scales have minute traces of black. The light, mid-dorsal row of spots extends onto the tail where there are five distinct and two indistinct ones. There the black borders are very indistinct. Beginning about twenty plates from the chin-shields, the ventrals are speckled with black more and more profusely toward the tail, under which the speckling is so profuse that the subcaudals appear black. Laterally the speckles are concentrated along the tips of the ventrals to form a line, while in general they are gathered along the bases of the scales. The tips of even the first twenty plates are black.



Fig. 7. *Pseudozoodon karlschmidti*, new species.

Head and neck pattern of juvenile paratype, A. M. N. H. No. 34641, four times natural size.

The ventral surface of the head is immaculate. The temporal region is darker than the dorsal surface of the head but there is no distinct postocular band. All but the last two upper labials on either side are narrowly bordered with black behind.

DESCRIPTION OF PARATYPES.—The characters and measurements of the six paratypes, all of which come from the type locality, follow (see table, p. 412). A. M. N. H. No. 21014 from Yenping, recorded by Schmidt (1927) as *dorsalis*, is included; it extends the known range of the species.

The fourth and fifth labials enter the orbit on both sides in four specimens, the third and fourth on one side, the fourth and fifth on the other in the fifth, while the condition in the sixth cannot be made out. The number of lower labials in contact with the anterior chin-shields is 4-5 in four, and 5-5 in one, while these shields are damaged in one.

The number of spots on the belly varies considerably. Two specimens are almost free of ventral spots, and one is thickly spotted, while three have a fair number of them. The spots always tend to be concentrated along the ends of the

ventrals. On the throat in some specimens are large, dull brown spots which disappear when the loose scales are removed. All the labial sutures are black in every paratype but one, and only one suture lacks the black in that one.

The juvenile color pattern is generally more vivid than the adult. The black bars at either end of the light mid-dorsal spots are very evident and the top of the head is reddish brown instead of blackish gray as in the adult. On the neck there is a strong, black spot with a point projecting forward to the tips of the parietals, and a lateral posterior projection on either side of the neck. This blotch is entirely lacking in the larger adult.

This species lacks the caudal stripe of *striaticaudatus* and has fewer dorsal and caudal spots than *fukienensis*. The conspicuous head and dorsal pattern of *fukienensis* contrasts strongly with the lack of such in *karlschmidti*. There are many further points of difference between these three related forms.

| A. M. N. H. Nos. | 34639 | 34640 | 34641 | 34660 | 34638 | 34659 | 21014 |
|---------------------|----------|----------|----------|----------|----------|----------|----------|
| Sex | ♂ | ♂ | ♂ | ♂ | ♀ | ♀ | ♀ |
| Dorsal Scales | 19-17-15 | 19-17-15 | 19-17-15 | 19-17-15 | 19-17-15 | 19-17-15 | 19-17-15 |
| Ventrals | 144 | 147 | 151 | 149 | 149 | 151 | 153 |
| Subcaudals | 58 | 60 | 60 | 52+ | 54 | 55 | 56 |
| Upper Labials | 8-8 | 7-8 | 8-8 | 8-8 | 8-8 | 8-8 | 8-8 |
| Lower Labials | ? | 9-10 | 9-10 | 10-10 | 9-10 | 8-10 | 9-9 |
| Preoculars | 1-1 | 1-1 | 1-1 | 1-1 | 1-1 | 1-1 | 1-1 |
| Postoculars | ? | 3-3 | 3-3 | 3-3 | 3-3 | 3-3 | 3-3 |
| Anterior Temporals | 2-2 | 2-2 | 2-2 | 2-2 | 2-2 | 2-2 | 2-2 |
| Posterior Temporals | 2-2 | 2-3 | 2-2 | 2-2 | 2-2 | 2-2 | 2-2 |
| Dorsal Spots | 24+? | 21+8 | 25+10 | 20+8 | 23+9 | 20+8 | 24+9 |
| Total Length | 256 | 358 | 315 | 756 | 308 | 660 | 243 |
| Tail/Total Length | .18 | .19 | .19 | .17+ | .17 | .18 | .18 |

Pseudoxenodon sinensis Boulenger

Figure 8

One specimen collected by Walter Granger at Hsin Kai, central Yunnan Province (No. 35211), represents this species.

The upper labials are 7-7, the lower 8-8; the preoculars 1-1, the postoculars 3-3; the anterior temporals 2-2, the posterior, 2-3. The scales are 19-17-15, with all but the outer row keeled at midbody. There are 148 ventrals and 65 subcaudals. The anal is divided and the total length is 283 mm., 0.20 of which is occupied by the tail. The specimen is a male.

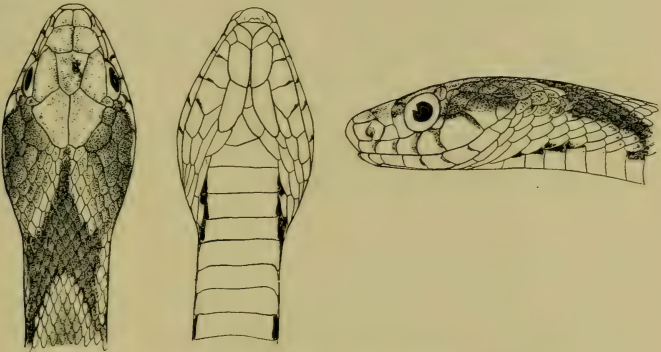


Fig. 8. *Pseudoxenodon sinensis* Boulenger.

Dorsal, ventral, and lateral views of head, A. M. N. H. No. 12791, twice natural size.

In order to make this matter doubly clear I will copy here Schmidt's (1927) table giving the counts and measurements for twenty-two specimens of *sinensis* from Yunnanfu.

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 8 | 138-146 | 144 |
| | ♀ | 14 | 149-162 | 155 |
| Caudals | ♂ | 7 | 60-68 | 62 |
| | ♀ | 14 | 57-66 | 61 |
| Tail/Total Length | ♂ | 7 | .18-.22 | .20 |
| | ♀ | 14 | .19-.20 | .19 |

ZAO CY S

The Chinese snakes of this genus present interesting problems of geographic variations that are worthy of careful study.

One of the species, *nigromarginatus*, is an Indian form shown by Stejneger (1925) and Schmidt (1927) to inhabit western China, Yunnan and Szechwan Provinces. Unfortunately, it has been confused with *dhumnades* even though the two species are amply distinct and do not intergrade. Stejneger records *nigromarginatus* as having a greater number of rows keeled, while Schmidt emphasizes its higher ventral count. Both of these characters are good but I find, upon examining a large series, that the differences in coloration are more reliable whenever evident. Unfortunately, the pattern may be entirely lost as in Nos. 23496, 23503, and 23510 from Wanhsien, Szechwan, in which the dorsum is a uniform, intense black and this in spite of the fact that one of the three measures only 880 mm. from snout to vent, while the largest measures 1228 mm. It is possible but not probable that this entire loss of pattern is the result of poor preservation.

A comparative description of the young will best show how fundamentally different the patterns of these related but distinct species are. It must be remembered that in *dhumnades* it tends to vanish posteriorly with age, while, as a rule, in *nigromarginatus* the caudal stripes are evident even in very large specimens. The persistence of stripes on the neck even in adult *dhumnades* and the lack of such in *nigromarginatus* of all sizes is not to be forgotten.

The pattern of No. 17707 (Fig. 9a), a juvenile *nigromarginatus* from Yunnanfu, is as follows. The length from snout to vent is 553 mm. A little more than the anterior third of the specimen is blue (green in life) and black, the black being confined to the edges of the scales. There is no sign of a stripe on this part. The ventral surface of the head and throat is milky, the entire remainder of the ventrum a slightly lighter shade of the ground color. About half-way between the head and tip of tail 4 black lines arise. These bands soon become intense, remaining so to the tip of the tail. As they intensify, the black borders of the intervening scales gradually disappear. Two head lengths before the vent the lower stripe covers two-thirds of the first row of scales, all of the second, and the edge of the third, while the upper one covers the edge of the fourth, all of the fifth and sixth, and the edge of the seventh. On the tail the first stripe covers the tips of the ventrals and half of the first row, while the second covers nearly all of the second and half of the third. The mid-dorsal ribbon of ground color covers, then, before as well as behind the vent, one half of each of the two mid-dorsal rows.

The pattern of No. 23540, (Fig. 9b) an example of typical *dhumnades* from Anhwei, is as follows. The specimen from snout to vent is 335

mm. long. The entire length posterior to the head is vividly striped with black, there being very little difference in the intensity of the stripes from the head to tip of tail. Anteriorly the intervening scales are black bordered but these borders gradually disappear posteriorly. The first stripe is weakest because the center of each scale involved retains a spot of the ground color. On the neck this first stripe is especially weak and occupies the third scale row. It strengthens as it progresses and, about half-way between the head and tip of tail, gradually shifts to the second row. Beyond the vent it occupies the tips of the ventrals and one-third of the first row. The upper stripe is intense and begins abruptly just behind the head, occupying the sixth, seventh, and border of the eighth row to a point about two head-lengths before the anus where it shifts to the fifth, sixth, and border of the seventh row, a result of the reduction in number of the scales. This means that throughout the two mid-dorsal rows retain their same position in relation to the upper stripes. Anteriorly the tip of the ventrals and the edges of the first row of scales are narrowly bordered with black, suggesting a third stripe. The ventrum is a shade lighter than the ground color, the ventral surface of the head milky. The transition from the light ventral color to the milky shade of the ventral surface of the head is very gradual.

When these color differences are understood the whole matter is simplified. *Z. nigromarginatus* may now be dropped. Stejneger, chiefly on the strength of a high subcaudal count, has separated the Formosan specimens as a distinct species, which he calls *oshimai*. He says that in color pattern this new form resembles *dhumnades*, so I conclude that Steindachner's *nigromarginatus* are really *oshimai*.

After carefully comparing Anhwei, Hunan, and Fukien specimens I conclude that on the mainland there is a lowland form with a low ventral and caudal count, and a mountain form with high counts. There are other differences, one of which is the blacker ventrum of the mountain snake. The number of caudals in the two Ch'ungan examples with complete tails are 131 and 137, so these approach *oshiami*, but ten among twelve have but two rows keeled while *oshimai* is said to have six. It seems necessary to describe the Ch'ungan examples as types of a subspecies of the typical lowland form which will be called *Zaocys dhumnades montanus*.

***Zaocys dhumnades dhumnades* (Cantor)**

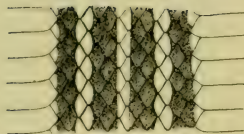
Figure 9b

One of the four Changsha specimens presented by Mr. J. W.

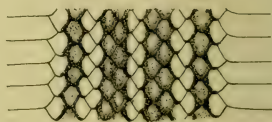
Williams (No. 24655) belongs here. Schmidt's 1927 report includes twenty-five Anhwei specimens.

Characters and Measurements of No. 24655

| | |
|---------------------|----------|
| Sex | ♂ |
| Dorsal Scales | 16-14 |
| Ventrals | 188 |
| Subcaudals | 112 |
| Upper Labials | 7-7 |
| Lower Labials | 10-10 |
| Preoculars | 2-2 |
| Postoculars | 1-1 |
| Anterior Temporals | 1-1 |
| Posterior Temporals | 1-1 |
| Total Length | 1463 mm. |
| Tail/Total Length | .30 |



a



b

Fig. 9. *Zaocys nigromarginatus* (Blyth) and *Zaocys dhumnades dhumnades* (Cantor).

a—Juvenile pattern two head-lengths before vent of *Zaocys nigromarginatus*, A. M. N. H. No. 17707, three times natural size.

b—Juvenile pattern two head-lengths before vent of *Zaocys dhumnades dhumnades*, A. M. N. H. No. 23540, five times natural size.

On the body posterior to the neck there are two rows sharply keeled, and from midbody to the tail, two more faintly keeled. The belly is light and the subcaudals only a shade darker than the throat.

In ventral as well as subcaudal count this specimen falls below the average given by Schmidt for the twenty-five examples of typical *dhumnades* from Anhwei. The light ventrum also helps to place it. Unfortunately, field notes are lacking but almost certainly it was not taken along with Nos. 17445, 17452, and 24621 here recorded as *Z. dhumnades montanus* from Changsha. There are many mountains as well as much low country in Hunan Province.

No. 24655 is anomalous in having irregular upper labial, postocular and temporal counts. The two first upper labials obviously are coalesced but the temporals and postoculars appear to be normal in form and relative size.

Zaocys dumnades montanus, new subspecies

TYPE.—A. M. N. H. No. 34334; ♀; Ch'ungan Hsien, northwest Fukien Province, China. April–September, 1926; Clifford H. Pope.

DIAGNOSIS.—Distinguished from the typical form by a higher ventral and caudal count. The ventrum is much darker than in typical *dumnades*.

DESCRIPTION OF TYPE.—Rostral broader than deep, visible from above; internasals shorter than the prefrontals, which are not as long as their distance from end of snout; frontal almost as long as its distance from tip of snout, just as long as parietals which are almost as broad as long; loreal longer than deep; a large preocular with a small one below; 2 postoculars, 2 anterior and 2 posterior temporals. Eight upper labials, fourth and fifth entering eye; 10 lower labials, first five in contact with anterior chin-shields; scales reduced from maximum of 16 to minimum of 14 at a point opposite 103d ventral; smooth on neck, 2 rows sharply keeled at midbody and before vent; ventrals 195; anal divided; subcaudals 123+; total length 1475 mm.+; about 0.28 occupied by tail.

The posterior half of the body above and below is slaty black. The milky color of the throat and ventral surface of the head merges with the darkening belly color. Anteriorly, on either side of the two mid-dorsal rows of scales, is a black stripe itself covering two scale rows. Below this stripe the scales have black borders and bluish centers. The lateral tips of the ventrals are edged with black. Some distance posterior to the head, the scales of the third row lose their light centers forming a narrow black stripe that is soon lost in the uniform black of the posterior section of the snake. The top and upper sides of the head are slate colored.

DESCRIPTION OF PARATYPES.—There are eleven paratypes from the type locality (Nos. 33627–632, and 34329–333), and one from Yenping (No. 33242). I also place A. M. N. H. Nos. 17445, 17452, and 24621 from Changsha, Hunan Province, here. The Changsha specimens were presented by Mr. J. W. Williams.

The characters and measurements of the eleven paratypes from Ch'ungan Hsien follow. The upper labials are 8–8 in ten, 8–9 in one; the lower, 10–10 in six, 10–11 in three, 9–10 and 11–11 in one each; the pre- and postoculars are without exception 2–2; the anterior temporals 2–2 in ten, 1–1 in one, the posterior 2–2 in ten, 2–3 in one. The scales are uniformly 16–14 with the two mid-dorsal rows keeled except on the neck. In addition, No. 33627 has the rows adjacent to the mid-dorsal pair weakly keeled on the last third of the body. The anal is always divided. Nearly all of the specimens were skinned in the field, so accurate measurements cannot be made. The longest skin, that of a female, measures 2300 mm. from tip to tip.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 9 | 191–203 | 198 |
| | ♀ | 2 | 200–203 | 201.5 |
| Caudals | ♂ | 1 | 131 | |
| | ♀ | 1 | 137 | |
| Tail/Total Length | ♂ | 1 | .28 | |
| | ♀ | 1 | .29 | |

The ventrum is considerably darker in this series than in the Anhwei lot but this character is hard to measure and too much stress should not be put on it because it is very variable. The color pattern varies greatly in intensity with age, the tails of the adults being black as in the type.

COLUBER

Coluber spinalis Peters

Fourteen specimens, nine from the Tsinan region, Shantung Province (Nos. 29724-732), three from the Western Hills near Peking (Nos. 29476-478), one from Kolobolchi Nor, Mongolia (No. 31843) and one from Mongolia (No. 31844). Schmidt (1927) reported seven specimens from Chihli and Shansi.

This series presents no difficulty but is remarkable for its general uniformity, there being as great variation among specimens from one locality as among those from widely separated regions. The upper labials are 8-8 in all but one in which they are 7-8; the lower are 10-10 in eleven, and 9-10 in three. The preoculars are 2-2 in thirteen, and 2-1 in one; the postoculars, uniformly 2-2 as are the anterior temporals. The posterior temporals are 3-3 in six, 2-2 in four, and 2-3 in four. One example, No. 29726, has a small extra scale just below the loreal. The scales are regularly 17-15. The anal is always divided. The three largest males measure from snout to vent 570, 557, and 539 mm., the largest females 755, 613, and 610 mm., respectively.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 7 | 188-192 | 189 |
| | ♀ | 7 | 201-207 | 204 |
| Caudals | ♂ | 6 | 91-99 | 94 |
| | ♀ | 6 | 90-93 | 96 |
| Tail/Total Length | ♂ | 6 | .27-.27 | .27 |
| | ♀ | 6 | .23-.27 | .26 |

PTYAS

Ptyas korros (Schlegel)

Twenty-five specimens, ten from Futsing Hsien (Nos. 33944-952 and 34107), nine from Yenping (Nos. 33245-252 and 35147), one from Ch'ungan Hsien (No. 34661), three from Hok'ou (Nos. 35080-082), and two from Yuan Kiang, Yunnan Province (Nos. 35235-236) represent this species. The last two were collected by Walter Granger. Schmidt

(1927) has reported on two specimens from Fukien, one of which came from Yenping, and seven from Hainan Island.

Stanley (1914 and 1917) records Fukien examples as does Stejneger (1925).

The present series is interesting only in the low subcaudal counts. Eleven of the Fukien-Kiangsi series have been examined critically, Nos. 33246, 33248-250, 33946, 33948-949, 33952, 34661, and 35080-081. The Yunnan specimens will be recorded separately. Eight of the eleven had upper labials 8-8, one 8-9, one 9-9 and one 7-8. The lower labials were 10-10 in seven, 11-12 in one, 9-10 in one, 11-11 in one, and 8-8 in one. The pre- and postoculars are uniformly 2-2 in all of the eleven. The anterior temporals are 2-2 in nine, and 2-3 in two; the posterior, 2-2 in eight, 2-3 in two, and 2-0 in one. The loreals were counted in all twenty-three and found to be 3-3 in thirteen, and 2-2 in ten. The scale formula is 15-13-11 in all. The number of rows drops from 15 to 13 at midbody, so these snakes by another might be recorded as having the formula 15-15-11 which is, as a matter of fact, given by Schmidt (1927) for seven of his nine Hainan examples. His seven and the present series undoubtedly have the same count.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 5 | 165-169 | 166 |
| | ♀ | 6 | 162-167 | 165 |
| Caudals | ♂ | 5 | 116-120 | 117 |
| | ♀ | 5 | 113-118 | 116 |
| Tail/Total Length | ♂ | 5 | .32-.34 | .334 |
| | ♀ | 5 | .32-.35 | .336 |

The three largest males measure 862, 820, and 798 mm. from snout to vent; the females 818, 775, and 717. In the juvenile specimens the base of many scales on the anterior two-thirds of the body is white. These white spots form irregular but discernible narrow cross-bands two to four scale-lengths apart. The rest of the body and the tail are uniformly dark. Traces of this pattern are retained in a female 802, and a male 603 mm. from snout to vent. However, slightly smaller examples sometimes lack them all together. It is most vivid in the smallest specimens.

The female from Yuan Kiang has 8 upper labials, the regular number of oculars and temporals, and 3 loreals. The scale formula agrees also. There are 9 lower labials on one side and the other side is damaged. The

Yuan Kiang male is also damaged but on the good side it has 10 lower labials, 3 loreals, and the usual number of upper labials, oculars and temporals. The scale formula agrees. The male has 173, the female 166, ventrals and the proportionate tail-lengths are .33 and .35 respectively. However, the subcaudals in the female are 128, and in the incomplete male 121. Here we have a distinct difference and comparing these with other specimens from the extreme south we see that *korros* from central China has a low subcaudal count. Stejneger (1907) gives five Siam specimens as ranging from 133 to 140 and Schmidt (1927) seven Hainan specimens as 128 to 141, while Wall (1903) found two in the Siccawei Museum at Shanghai with 100 and 116 subcaudals, respectively. I take it that these two are Yangtze Valley snakes. Formosan examples are puzzling. It is not the present purpose to take the question up in detail but only to suggest it so that others may be stimulated to give subcaudal counts.

Frogs, probably *Ranas*, were found in seven stomachs. This indicates that *korros* confines itself to such a diet.

Like *mucosus* this snake does not range into the forests of the Kuatun mountains though it is found on the Ch'ungan plateau.

***Ptyas mucosus* (Linnæus)**

Eleven specimens, five from Futsing Hsien (Nos. 33953-957), three from Yenping (Nos. 33241 and 33243-244), one from Ch'ungan Hsien (No. 33622), and two from Hok'ou (Nos. 35053-054), make up the series of this species.

Schmidt's (1927) report included eleven examples from Hainan. Stanley (1914) has reported specimens from Fukien.

There is no important variation in the present series except the lack of dorsal bars posteriorly in the Yenping specimen. These bars are well broken up in the two Hok'ou snakes. The upper labials are uniformly 8-8, the lower, 10-10 in eight, 11-11 in two, and 9-10 in one. The pre-as well as the postoculars are 2-2 in all. The anterior and posterior temporals are 2-2 in all but three examples. In one of these a tiny scale is inserted between the paired temporals, but on one side only; in another on one side one, and on the other side two extra small scales are thus inserted, while in the third two extras are found on the one and three on the other side. The scales are 19-17-14, and, as Schmidt remarks, are not keeled far anteriorly.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrols | ♂ | 4 | 192-196 | 194 |
| | ♀ | 7 | 194-197 | 195 |
| Caudals | ♂ | 2 | 111-114 | 112.5 |
| | ♀ | 6 | 105-114 | 108 |
| Tail/Total Length | ♂ | | | |
| | ♀ | 2 | .25-.25 | |

The figures agree well with those for the Hainan lot.

The remains of several small *Bufos* were found in one Hok'ou specimen.

Like *korros* this species does not range into the Kautun mountains though it was found on the Ch'ungan plateau and was common about Yenping and Hok'ou and in Futsing Hsien.

TAPINOPHIS

Tapinophis latouchi Boulenger

Eighty-two specimens, sixty-nine from Ch'ungan Hsien (Nos. 33711-730, 33733-734, 33743, and 34441-486), twelve from Yenping (Nos. 33294-305), and one from Futsing (No. 33943), make up the series. In addition, there are three lots of embryonic material (Nos. 34489-491) from Ch'ungan Hsien.

The largest lot comes from the type locality whence Boulenger (1899) described not only the species but the genus as well. Mell (1922) records *latouchi* as common in the Kwangtung-Hunan-Kiangsi border region, and Stejneger (1925) reports one from Kuliang, Fukien Province, collected by Mr. Sowerby. Werner (1919)¹ gives Fukien records also.

Mell is sure of its occurrence about Talifu, Yunnan Province.

Seventeen specimens (Nos. 33295-298, 33713, 33717, 33719, 33721-722, 33943, 34455, 34457, 34463-464, 34472, 34474, etc.) from the three localities have been studied. In seven of these the upper labials are 8-9, in six more they are 9-9, while in the remaining four there are 8 on a side. The lower labials are 8-9 in nine, 8-8 in four, 9-9 in two, 9-10 in one, and 8-10 in one. There is but one preocular on a side in all but one example which has two on each side. The postoculars are 2-2 in fifteen, 1-1 in one, and 1-2 in the remaining one. The anterior temporals are uniformly 1-1; the posterior, 2-2 in nine, 1-1 in six, and 1-2 in two. The scales are 17 throughout and keeled except on the neck.

¹This *Cantonophis praefrontalis*. See Stejneger (1925a) *T. latouchi* synonymy.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 9 | 153-163 | 157 |
| | ♀ | 8 | 146-157 | 151 |
| Caudals | ♂ | 7 | 55-63 | 60 |
| | ♀ | 8 | 50-59 | 54 |
| Tail/Total Length | ♂ | 7 | .19-.22 | .209 |
| | ♀ | 8 | .19-.20 | .198 |

The anal is always divided. From snout to vent the three largest females measure 419, 406, and 399 mm., the three largest males 395, 361, and 360 mm., respectively.

In the juvenile examples each scale has a light longitudinal central area, the result being a finely lined general pattern. This is marked in the oldest embryos but in the largest adults the light streaks are noticeable only on the sides and even these in varying degree. Thus the oldest snakes retain only a vestige of this lined pattern. The first scale-row is never entirely pigmented and in seven examples out of the whole series it is free from color except for possible tiny traces on a few posterior scales. In seven more there are distinct but scattered fragments of color on this first row.

Boulenger (1899) says that there is a median line under the tail. In the entire Ch'ungan series of sixty-nine there is never a complete line under the tail and even fragments of such a line exist in only six examples. In three of the six the fragments put together would not equal half the tail-length. However, among the twelve Yenping examples four have such a line complete while only two lack it altogether. In three others, the fragments put together cover from one-third to three-fourths of the tail-length. There is no trace of the line, then, in 96 per cent of the Ch'ungan series against 17 per cent of those from Yenping. This is the only difference I am able to find between the two lots from the two localities.

The number of eggs ranges from 1 to 4. Thirteen females contained 3 eggs, eight contained 2, while 4 eggs were found in only six. A single one held but 1 egg. The following field records are not included in the figures just given. On July 8 one of these snakes was brought in at Kuatun with two pale yellow eggs measuring 37×7 mm. and 31×5 mm., respectively. On the 12th a Kuatun collector found a *latouchi* coiled about three eggs placed under a flat stone in the bed of a cascading stream. The eggs, according to him, were only half submerged. They were white

with yellowish tips and averaged 29 mm. in length. His report should be credited.

On August 15 a Kuatun man brought in three white eggs containing barely pigmented *latouchi* embryos (No. 34489). Two of the three eggs were adherent. On the 19th two white eggs containing well-pigmented *latouchi* embryos (No. 34490) were bought also at Kuatun. Finally, on the 28th at Kuatun four white, adherent eggs containing advanced embryos were secured (No. 34491). The longest was 28.5, the shortest, 25.5 mm. from tip to tip. The extreme measurements of the lesser diameter were 13.6 and 16.5. mm., respectively.

T. latouchi seemed to be rare in Futsing but this may be due to the scarcity of suitable cascades there. It was fairly common at Yenping but in the Kuatun mountains it was abundant even in the tiniest forest streams. It is a burrower in the beds of mountain springs and streams. In the day it may be found buried under loose rock, gravel and decaying vegetable matter in cold watercourses of all sizes. At night it is more easily discovered. When uncovered it at once attempts to burrow deeper and this it can do with great skill. We found that it cannot live in dry containers as the various species of *Natrix* can, for we lost several in attempting to send them only a few miles out of water. When handled it shows no signs of defensive behavior but emits a strong musky odor. It makes endless attempts to burrow or hide under something.

One specimen vomited a large earthworm and remains of such were found in the stomachs of five. In eight more the stomachs contained masses of gritty earth strongly suggestive of the same diet. The rest of the stomachs were empty.

OPISTHOTROPIS

Opisthotropis kuatunensis, new species

Figure 10

TYPE.—A. M. N. H. No. 34437; ♀; Ch'ungan Hsien, northwest Fukien Province, China; April–September, 1926; Clifford H. Pope.

DIAGNOSIS.—An *Opisthotropis* allied through strongly keeled scales and a low upper labial count to *rugosa* and *typica* of Sumatra and Borneo. The nasals are undivided and the prefrontal single.

DESCRIPTION OF TYPE.—Maxillary teeth 25, small, subequal. Head broad, depressed; nostrils near upper edge of the nasals which are not in contact. Internasals long, curved outward; prefrontal single. Frontal large, a little longer than broad, much shorter than parietals. Supraoculars divided on one side, entire on other; loreal longer than deep. Preoculars 2–2; postoculars 2–3. A total of 6 scales enter orbit on one side, 9 on other. Anterior temporals 1–1. Only first six upper labials on one side, first eight on other, extend from head shields to labial border; those following are divided horizontally, first into double, then triple, then again double rows. Their

number, when only those entering margin are counted, may be given as 15-16; lower labials are even more irregular. The very finely rugose anterior chin-shields are several times the size of narrow posterior ones. Scales in 19 rows, striated and strongly keeled throughout. Ventrals 160; anal divided; subcaudals 63. The tail occupies 0.23 of total length which is 666 mm.

The uniform olive-brown of the back extends down on either side to the third row of scales and is marked only by three very obscure, black, longitudinal lines, each as wide as a scale. The belly and first three rows of scales on either side are uniformly light. The ventral surface of the tail is clouded except just behind the anus.

DESCRIPTION OF PARATYPES.—The 15 paratypes (Nos. 33708-710, 34428-436, and 34438-440) come from the type locality, and agree with the type in the chief characters except that in No. 33710 there is a suture from the nostril to the edge of the nasal adjacent to the labials.

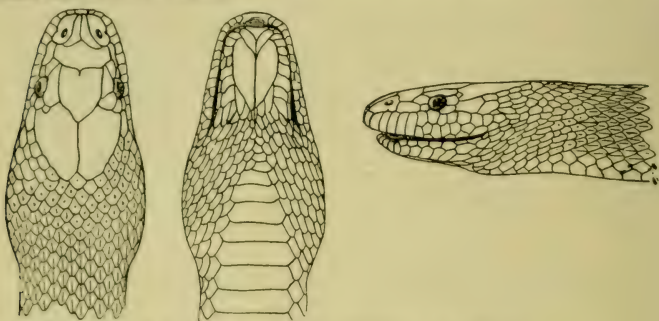


Fig. 10. *Opisthotropis kuatunensis*, new species.
Dorsal, ventral, and lateral views of head of type, three times natural size.

The upper labials are 14-15 in six; 16-16, 14-16, and 15-16 in two each; 15-15, 14-14, and 13-15 in one each. The figure of the type well illustrates the arrangement of the labials, which does not vary to a marked degree. The total number of scales entering the orbit is 8-8 in four, 8-9 in three, 7-9 and 6-7 in two each, 7-8, 7-7, 9-9, and 9-10 in one each. The preoculars are 2-2 in twelve, and 2-3 in three. The anterior temporals are 1-1 in thirteen, 2-2 and 1-2 in one each. In two specimens there are several small scales between the temporals and the postoculars. The scales are always 19 throughout and all the anals are divided. The only two males measure from snout to vent 523 and 513 mm., the four largest females 525, 523, 521, and 516 mm., respectively.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|------------------|----------|----------|
| Ventrals | ♂ | 2 | 168-168 | |
| | ♀ | 13 | 146-154 | 150 |
| Caudals | ♂ | 1 | 59 | |
| | ♀ | 11 | 61-68 | 64.7 |
| Tail/Total Length | ♂ | 1 | .20 | |
| | ♀ | 11 | .22-.24 | .227 |

The dorsal olive-brown may encroach on the third and even the second row of scales but the first is always free of pigment. Ten adults lack practically all traces of the three black, longitudinal lines, while in the two juveniles these lines are quite distinct. The ventral surface of the tail is always clouded for at least the greater part of its length.

These snakes inhabit the highest forest cascades of the mountains about Kuatun and San Chiang. They are very secretive and during the day are to be found concealed under loose rock, gravel and other débris forming the beds of the streams. I found one abroad in the bed of a large stream one night. When disturbed they only try to burrow into the surrounding débris and have no idea of biting or defending themselves except through flight. When handled they give off a strong, musky odor. They strongly resemble *Tapinophis latouchi* in behavior and habits, but are nothing like as abundant nor do they frequent the lower streams as in the case of *latouchi*.

Three females contained 5 eggs, two more 6, but one held only 3.

TRIRHINOPHOLIS

Trirhinopholis styani Boulenger

Nine specimens, all from Ch'ungan Hsien (Nos. 34626-634) represent this species. They come from the type locality. Boulenger (1899) described this species from two Kuatun specimens. Since then Thompson (1913) has recorded a Chekiang specimen, Stanley (1914 and 1915) has reported it from Chekiang, Kiangsi, and Fukien Provinces; and Stéjneger (1925) records ten examples from Szechwan Province and one from Foochow.

The present specimens conform well with former ones. In all there are 6 upper and 6 lower labials on each side. The preoculars are uniformly 1-1, the postoculars, 2-2. There is a loreal on only one side of one specimen. There are 2 anterior temporals in all, but the posterior temporals are 2-2 in eight, and 2-1 in the remaining one. The scale formula is always 15-15-15.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------|-----|---------------------|----------|---------|
| Ventrols | ♂ | 3 | 114-118 | 116 |
| | ♀ | 4 | 121-126 | 123.5 |
| Caudals | ♂ | 3 | 27-29 | 28 |
| | ♀ | 4 | 22-29 | 26 |
| Tail/Total Length | ♂ | 3 | .13-.14 | .137 |
| | ♀ | 4 | .11-.12 | .118 |

The anal is always entire. Two juvenile specimens of doubtful sex had, respectively, 121, 29, .13, and 120, 26, .13 ventrals, subcaudals, and proportionate tail-length. The females measure from snout to vent 338, 315, 311, and 285 mm., the males 303, 239, and 197 mm., respectively.

A female contained 7 eggs, one of which measured 15.5×5.5 mm. The stomachs of three contained a lot of gritty dirt suggestive of an earthworm diet.

This snake was found in the high forests and bamboo groves about Kuatun. It is active and uses its head like a burrower. When teased it neither strikes, bites, nor assumes a defensive position. One specimen, when annoyed, flattened its body.

LYCODON

Lycodon fasciatus (Anderson)

A single male specimen (No. 35209) was collected at Yunnanfu, Yunnan Province, by Walter Granger. Schmidt (1927) reported one also from Yunnanfu.

The upper as well as the lower labials are 8-8 in No. 35209, and there are about 2 temporals on a side. On the neck and at midbody the scales are in 17 rows but just before the anus they are only in 15. The ventral count is 191, the subcaudal 76. The total length is 513 mm., 0.21 of which is occupied by the tail.

There are 27 jagged edged, white rings on the body, and 12 on the tail. Anteriorly along the middle of the back, these are a scale-length in width, but on the tail they increase to a width as great as the length of two scales while all along on the belly they are as wide as two ventral plates. On the neck the black interspaces cover the length of about 10 scales, posteriorly only 5.

Wall (1924) gives the range of ventrals as 201-213; subcaudals 74-94. Schmidt's Yunnan specimen had 195 ventrals and 70 subcaudals so it is entirely possible, as suggested by Schmidt, that eastern Yunnan is inhabited by a subspecies with low counts and certainly the averages will prove to be different. Because of close agreement in other characters and the lack of a series of eastern specimens I prefer to let the matter rest for the present. The type of *fasciatus* was taken near the western border of Yunnan, east of Bhamo, so according to the distribution given by Wall (1924) it really came from a locality intermediate between Assam and the interior of Yunnan.

DINODON***Dinodon futsingensis*, new species**

Figure 11

TYPE.—A. M. N. H. No. 34106; juvenile ♀; Futsing Hsien, Fukien Province, China; August–October, 1925; Clifford H. Pope.

DIAGNOSIS.—A black and white banded *Dinodon* allied to *ruhstrati*. The scales are smooth, in 17 rows on the neck and body to a point opposite the seventy-third ventral plate counted forward from the anus. Posterior to this plate they are in 15 rows. There are 197 ventrals, 79 subcaudals. Apical pits double.

DESCRIPTION OF TYPE.—On the anterior extremity of the maxillary there are 4 small, subequal teeth. These are followed immediately by 4 much larger ones, the third of which is the longest. The remaining teeth, about 3 in number, are arranged along the maxillary some distance behind the first eight.

Rostral broader than deep, plainly visible from above; internasals distinctly narrower than the prefrontals and only half as long. Frontal slightly longer than broad, shorter than parietals, as long as its distance from end of snout. Loreal twice as long as deep, not entering eye; preoculars 1–1; postoculars 2–2; anterior temporals 2–2; posterior, 3–3. Upper labials 8–8, the third, fourth and fifth entering the orbit



Fig. 11. *Dinodon futsingensis*, new species.

Dorsal and ventral views of head of type, four times natural size.

on one side, the fourth, fifth and sixth, on the other; lower labials 10–10, the first five in contact with the anterior chin-shields which are a little shorter than the posterior. Anal entire, subcaudals divided. Total length 227 mm., 0.21 occupied by tail.

The body is black, crossed by 22 white bands which are two scale-lengths in width on the middle of the back but wider on the sides where they join the faintly clouded, white belly. Nearly all of these bands split just before they reach the ventrals. The twelve white bands on the tail scarcely widen laterally. Except on the neck, where they are much more widely separated, these white bands are five to six scale-lengths apart. The suboculars are dark. There is a conspicuous white area extending anteriorly as far as the eyes and posteriorly three scales-lengths behind the parietals. Laterally it extends to the next to the last upper labial and finally joins the white of the throat. There are slight traces of black on this area, the most conspicuous being a narrow line from the posterior tip of the parietals to the beginning of the black ground color of the neck.

DESCRIPTION OF PARATYPE.—The single paratype, No. 34105, was taken along with the type and exactly agrees with it in sex, body and tail-length, and number of

bands on the tail. It has, however, 25 bands on the body. The upper labials are 8-8, the third, fourth, and fifth entering the eye; the lower, 10-11, five in contact with the anterior chin-shields on one side, six on the other. As in the type the preoculars are 1-1, the postoculars 2-2; the anterior temporals 2-2, the posterior, 3-3. The scales are in 17 rows as far back as the seventy-fifth ventral plate counted forward from the anus; at that point they are reduced to 15. There are 204 ventrals and 77 subcaudals. The anal is entire.

These 2 snakes were taken in the wooded mountains surrounding Ling Shih Szu.

***Dinodon ruhstrati* (Fischer)**

Three examples (Nos. 34584-586) from Ch'ungan Hsien represent this species.

Characters and Measurements

| A. M. N. H. Nos. | 34584 | 34585 | 34586 |
|--------------------------|----------|----------|----------|
| Sex | ♀ | ♀ | ♂ |
| Scales | 17-17-15 | 17-17-15 | 17-17-15 |
| Ventrals | 221 | 227 | 223 |
| Subcaudals | 92 | 94 | 92 |
| Upper Labials | 8-8 | 8-8 | 8-8 |
| Lower Labials | 9-9(?) | 10-10 | 10-10 |
| Preoculars | 1-1 | 1-1 | 1-1 |
| Postoculars | 2-2 | 2-2 | 2-2 |
| Anterior Temporals | 2-2 | 1-1 | 2-2 |
| Posterior Temporals | 3-3 | 2-2 | 3-3 |
| Light Dorsal Cross-Bands | 35+14 | 36+17 | 33+15 |
| Total Length | 817 | 672 | 729 |
| Tail/Total Length | .22 | .22 | .22 |

The third, fourth and fifth upper labials enter the orbit; the first four lower labials are in contact with the anterior chin-shields in No. 34584, the first five in the other two. The loreal is pointed posteriorly in all and fails to reach the eye in two, barely doing so in the third, No. 34585. At midbody 9 to 10 scale rows are keeled. The anal is divided in all, and the apical pits are double. The light cross-bands are narrow and far apart anteriorly, but they widen and become more numerous toward the tail, actually becoming, in No. 34585, wider than the black areas of ground color. In No. 34584 they are never more than one-third the width of the black interspaces, while in No. 34586 they attain a width equal to half that of the intervening black. Posterior to the anus the dorsal pattern extends on to the ventrals so that the tails are completely ringed. In No. 34586 this is the case just before as well as behind the anus, and this specimen has more spots on the ventrals than No. 34585, while No. 34586 almost entirely lacks markings on the belly. In No. 34585 a broad, white band crosses the head. Anteriorly it reaches the

postoculars, posteriorly to about three scale-lengths beyond the end of the parietals. In the other two only an outline is evident, the band itself being almost obliterated by the clouding.

One stomach contained the remains of a small skink, another that of a species of *Takydromus*. The gravid female held 4 well-developed eggs, one of which measures 33×8 mm.

The three specimens were taken by torch-light at night in the beds of high mountain streams of the Kuatun neighborhood. No others were seen or heard of. Teasing caused one of these snakes to strike. It was very agile and quick in its movements.

Pratt's Kiukiang specimen included in Boulenger's 1893 description appears to agree well in pattern with the present specimens, but Boulenger's three Kuatun specimens listed as *septentrionalis* are puzzling because he remarks on the narrowness of the white areas and fails to mention the reversal in width of the bands from neck to tail. Moreover, this species is extremely rare at Kuatun and it is not likely that such a small collection would have had so many specimens of a rare species but none of the common *flavozonatum* described herein as new. I strongly suspect that Boulenger's Kuatun *septentrionalis* are in reality *ruhstrati*. This would also explain the failure of the former species to turn up in the present large collection.

Formosan *ruhstrati*, now known from thirteen specimens, has a ventral range of 212-224; a subcaudal range of 81-116. Pratt's Kiukiang specimen had but 211 ventrals and 88 subcaudals, while the present series has 221 to 227, and 92 to 94 ventrals and subcaudals, respectively. The exact relationship of the mainland and insular forms must await further material for clarification.

***Dinodon rufozonatum rufozonatum* (Cantor)**

Twenty-eight specimens, seventeen from the Western Hills, Peking, (Nos. 29390-403 and 29501-503), and eleven from the region of Tsinan, Shantung Province (Nos. 29686-695 and 29697).

Schmidt (1927) reported twenty-six examples from Chihli, Shansi, and Anhwei Provinces. Stanley (1914) records specimens from Anhwei, Chekiang, Chihli, Fukien, Kiangsi, Shantung, and Szechwan Provinces, but it is of course impossible to tell their exact status.

There is nothing striking about the present series. The upper labials are 8-8 in all, the lower 10-10 in twenty-four, 10-11 in one, 9-10 in one, and 11-11 in No. 29687. There is a single preocular everywhere except on one side in No. 29392 where it is lacking all together, and the post-

oculars are 2-2 in twenty-seven, and 1-1 in No. 29639. The anterior temporals are 2-2 in all, the posterior 3-3 in twenty-five, and 2-3 in three specimens from Western Hills. The scale formula is 17-17-15 in all but four from the Western Hills in which it is 17-17-17, 19-17-15, 19-19-15, and 20-19-15, respectively. All anals are divided; apical pits double. The three largest males measure from snout to vent 910, 902, and 859 mm., respectively, the largest females 980, 930, and 825 mm. The females probably average the larger. In this series they are out-numbered, there being fifteen males to thirteen females. Also two of the three juvenile specimens are females.

The loreal enters the eye in seven out of eleven, or 64 per cent of the Shantung lot; in nine out of seventeen, or 53 per cent of the Peking snakes. This character is very variable for Schmidt found that "the loreal enters the eye in 69 per cent of the Anhwei series and only in 35 per cent of the northern specimens." It must not be forgotten that 80 per cent of Schmidt's "northern" specimens came from Shansi. The loreal enters the eye in 92 per cent (eleven out of twelve) of the *williamsi* in the present series while, in the original six, type and paratypes, it enters everywhere except on one side in one specimen. We may conclude that this scale enters the eye more and more frequently as we proceed south and southeast from Shansi Province.

Summary of Counts and Measurements

| Shantung Series | | | | |
|-------------------|-------|---------------------|----------|----------|
| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
| Ventrals | ♂ | 7 | 199-203 | 200 |
| | ♀ | 4 | 197-200 | 198 |
| Caudals | ♂ | 6 | 69-76 | 73 |
| | ♀ | 3 | 66-68 | 67 |
| Tail/Total Length | ♂ | 6 | .18-.19 | .18 |
| | ♀ | 3 | .17-.19 | .18 |
| Body Bands | ♂ + ♀ | 11 | 62-85 | |
| Tail Bands | ♂ + ♀ | 11 | 20-28 | |
| Peking Series | | | | |
| Ventrals | ♂ | 8 | 195-198 | 196.5 |
| | ♀ | 9 | 191-197 | 193 |
| Caudals | ♂ | 7 | 67-69 | 68 |
| | ♀ | 8 | 64-68 | 66 |
| Tail/Total Length | ♂ | 7 | .17-.19 | .181 |
| | ♀ | 8 | .16-.18 | .172 |
| Body Bands | ♂ + ♀ | 14 | 45-66 | |
| Tail Bands | ♂ + ♀ | 14 | 16-23 | |

One female contained 11 well-developed eggs, one of which measures 15×13 mm. Another specimen held 8 well and 3 badly formed eggs.

Wall (1903) reports this snake as common about Shanghai. I found it so in Anhwei where it seemed to frequent native farm compounds. Jacot (1923) says that it is "commonly found about water courses." This I can also verify. I caught one that I saw in a small stream by tying a frog near to where it had secreted itself among the rocks and returning later to find it held by the string still tied to the frog which it had swallowed. Wall says that its disposition is good and this also I can verify, though some individuals will bite viciously.

This species has a diversified appetite. A Yenping *williamsi* had a loach in its stomach and another a frog, while two other stomachs contained skink remains. Two specimens of the typical form from Shantung in the present collection held frog (*Rana*) and one toad (*Bufo*) remains. Wall (1903) records one that had eaten a toad, while Jacot (1923) says it feeds on frogs and toads. In Chihli I saw one in the act of devouring a viper (*Agkistrodon halys brevicaudus*) not much smaller than itself, and in Anhwei I squeezed a toad out of a specimen.

***Dinodon rufozonatum williamsi* Schmidt¹**

Twelve specimens, one from Yenping (No. 33488), nine from Ch'ungan Hsien (Nos. 33648-649, and 34363-369), and two from Hok'ou (Nos. 35057-058) represent this species.

Schmidt (1927) based this subspecies on its "greater number of ventrals, subcaudals, and transverse dorsal markings." It is interesting to note that my Fukien-Kiangsi series agrees closely with his six from Changsha, but does not bridge the gap between *williamsi* and the typical form from nearby Anhwei though the Anhwei series is a large one. In order to simplify this complex matter I have made out a table which shows in brief the whole situation. Minor details, such as the exact number of specimens from which the caudal counts were made, have been disregarded, the number given for each series being the total of that series. Allowance must therefore be made for the few incomplete tails of each lot. These details may be noted in the several individual tables.

¹Paratypes Nos. 17432-3 and 17454-7, misplaced for some time, were found too late to be included in the following discussion or the summaries in the introduction to this paper.

Counts of *rufozonatum rufozonatum* and *rufozonatum williamsi* Compared
(Only extremes given)

| | VENTRAL PLATES | CAUDAL PLATES | TRANSVERSE DORSAL MARKINGS | |
|---|-------------------|------------------|-------------------------------|-------|
| | | | Body | Tail |
| Changsha <i>williamsi</i> (6 specimens) | 207-213 | 77-86 | 59-74 | 21-26 |
| Fukien-Kiangsi <i>williamsi</i> (12 specimens) | 207-219 | 76-88 | 54-74 | 15-29 |
| Typical <i>rufozonatum</i> from Chihli, Shansi and Shantung (38 specimens) | 188-203 | 60-76 | 43-66 | 12-23 |
| Typical <i>rufozonatum</i> from Anhwei (13 specimens) | 196-205 | 65-84 | 50-70 | 14-26 |

There is nothing to do but await the acquisition of larger series from intermediate regions.

The details of the twelve *williamsi* from Fukien and Kiangsi are as follows. The upper labials are always 8-8, the lower 10-10 in eight, 9-10 in three, and 11-11 in one. The preoculars are uniformly 1-1, the postoculars 2-2. The anterior temporals are 2-2 in all, the posterior 3-3 in eight, and 2-3 in the rest. The loreal enters the eye in all but No. 35058. The scales are uniformly 15 before the vent; 17 (in four) or 19 (in seven) at midbody; and 19 on the neck in all but one which has 21. From snout to vent the largest females measure 995 and 975 mm., the largest males 840 and 755 mm. respectively.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-------|---------------------|----------|----------|
| Ventrals | ♂ | 6 | 207-219 | 211 |
| | ♀ | 6 | 209-218 | 214.5 |
| Caudals | ♂ | 5 | 79-88 | 81 |
| | ♀ | 4 | 76-82 | 79.5 |
| Tail/Total Length | ♂ | 5 | .18-.20 | .192 |
| | ♀ | 4 | .19-.21 | .197 |
| Transverse Dorsal | | | | |
| Markings on Body | ♂ + ♀ | 12 | 54-74 | |
| Transverse Dorsal | | | | |
| Markings on Tail | ♂ + ♀ | 10 | 16-29 | |

A loach was found in one, a frog in another, and a skink in each of two others.

Evidently rare at Yenping, *williamsi* is not uncommon in the Kuatun forests though it is probably more at home in the hilly and flat country of south central China. I caught a specimen one night crawling along the rockwork face of a San Chiang rice-field terrace, a decidedly wet place.

***Dinodon flavozonatum*, new species**

Figures 12 and 13

TYPE.—A. M. N. H. No. 34371; ♂; Ch'ungan Hsien, northwest Fukien Province, China; April-September, 1926; Clifford H. Pope.

DIAGNOSIS.—Closely allied to *rufozonatum* from which it differs chiefly in having yellow instead of red cross-bands.

DESCRIPTION OF TYPE.—Rostral broader than deep plainly visible from above; internasals much shorter than prefrontals, which are a little shorter than frontal; frontal slightly longer than broad, just as long as its distance from rostral; length of parietals equals their distance from end of snout; loreal longer than deep, not entering eye. One pre- and two postoculars; temporals 2-3; 8 upper labials, third, fourth, and fifth entering eye; 10 lower labials, first five in contact with anterior chin-shields which are as long as, and slightly broader than posterior. Scales in 17 rows to a point opposite seventy-first ventral plate from anus where fourth row drops out; in 15 rows posterior to this; 7 rows feebly keeled at midbody; all scales smooth on neck. Ventrals 218; anal entire; subcaudals 87; apical pits double. Total length 965 mm., 0.20 of which is tail-length.

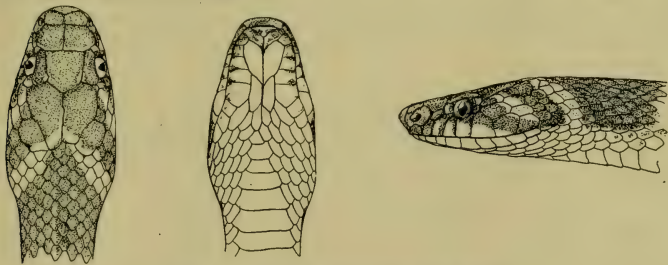


Fig. 12. *Dinodon flavozonatum*, new species.

Dorsal, ventral, and lateral views of head of type, twice natural size.

The uniformly black ground color of the dorsum is crossed anterior to the vent at regular intervals by 68 narrow, yellow bands each about half as wide as a scale is long. Every band divided on the fifth scale-row, each half joining a branch from the adjacent ones before descending to the ventrals. This lateral pattern is not very distinct and encroaches slightly on the white ventrals. Most of the 21 tail-bands are as wide as a scale is long, and none of them splits laterally. The subcaudals are black, weakly light mottled. The top of the head is black save for a yellow stripe from behind the eye to the angle of the mouth; narrow yellow borders on some of the plates, and a nuchal V-shaped, yellow band with its apex on the posterior tips of the parietals.

The first two and the eighth or last upper labials are black, the rest black and yellow. The throat is white except for black trimmings on the anterior lower labials. The yellow of the dorsum fades with preservation into a dirty white.

DESCRIPTION OF PARATYPES.—The nineteen paratypes (Nos. 33641-647, 34370, and 34372-82) come from the type locality.

The upper labials are uniformly 8-8, the third, fourth and fifth entering the eye; the lower, 10-10 in thirteen, 9-9 and 9-10 in two each, 8-8 and 8-10 in one each; 5 in contact with the anterior chin-shields in seventeen, 4 in one, 4 on one side and 5 on the other in the remaining one. The preoculars are always 1-1, the postoculars 2-2; the anterior temporals invariably 2-2, the posterior 3-3 in seven, 2-2 in six, 2-3 in five, and 2-? in a damaged example. There are always 17 rows of scales on the neck and at midbody, 15 before the anus. The anal is always entire. Among eight specimens the number of scale-rows keeled at midbody varies from 6 to 9, just half having 7 rows keeled. The only four females measure from snout to vent 671, 668, 590, and 460 mm., respectively. The four largest males measure 825, 815, 805, and 790 mm. The

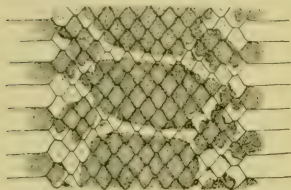


Fig. 13. *Dinodon flavozonatum*, new species.

Dorsal color pattern of type, twice natural size.

number of dorsal cross-bands ranges from 51 to 78 on the body and 17 to 24 on the tail. On the whole the color pattern is remarkably constant but there is variation in the lateral pattern which is often confused and irregular. The color pattern is remarkably like that of *rufozonatum* except that the cross-bands in this species are yellow instead of red.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 15 | 211-221 | 217 |
| | ♀ | 4 | 212-218 | 214.5 |
| Caudals | ♂ | 10 | 81-88 | 84 |
| | ♀ | 4 | 80-84 | 81 |
| Tail/Total Length | ♂ | 10 | .19-.20 | .197 |
| | ♀ | 4 | .18-.20 | .189 |

One snake had eaten a lizard (*Takydromus* sp.), another a skink, and a third a comparatively large snake of the genus *Holarchus* (No. 29943).

This species was encountered only in the high forests of the Kuatun region where it was not uncommon. It resembles *rufozonatum* in disposition.

Mell and Vogt (1922) record *semicarinatum* from Kwangtung but the meagre description given does not enable one to determine the relationship between mainland and insular *semicarinatum* and the Fukien material,

coming as it does from intermediate territory. Vogt gives the cross-bands as 60, while in Stejneger's specimen there are only 40. This higher number suggests relationship to the Fukien species.

ACHALINUS

Achalinus spinalis Peters

Fifteen specimens from Ch'ungan Hsien (Nos. 33750-751 and 34613-625) make up the series of this rare species.

Stejneger (1925) first reported this snake from Fukien but Stanley (1914) has recorded it from Chekiang Province.

The present series substantiates Stejneger's conclusion that *braconieri* and *spinalis* are identical. His Foochow specimen with a mid-dorsal stripe removed the last distinction between these two species. The five additional characters that were supposed to separate them will also be enumerated below.

1. MID-DORSAL STRIPE.—Ten out of fourteen (71 per cent) of the series at hand have the stripe but it is faint in six of them. In all but two it covers the width of one scale only but in those two it is twice as wide.

2. SCALE ROWS.—The scale formula in six out of fourteen is 23-23-23 and in five more it is 23-23-21. Two are irregular with 23-23-22 and two have 21 rows throughout. At midbody there are 23 rows in about one-seventh of this lot while, in Stejneger's (1907) list of seven Japanese examples one of the seven has 21 rows. Here again is noteworthy agreement.

3. COMPARATIVE LENGTHS OF INTERNASAL AND INTERPREFRONTAL SUTURES.—Even though the former is always shorter than the latter both vary considerably and the character may be rated as a bad one.

4. NUMBER OF CHIN-SHIELDS.—Here we get the greatest difference, for thirteen of the present lot have regularly but two pairs and the remaining two have three on only one side, as is the case in Stejneger's recent Foochow specimen. We may conclude that two is the normal number for mainland specimens.

5. VENTRAL AND SUBCAUDAL COUNTS.—Here is remarkable agreement, for the range in my fifteen is just the same as in Stejneger's six, 146-166 ventrals. My average is 158, his 159. The subcaudal counts do not agree so well for his series ranges from 49 to 62, mine from 39 to 56. My average is 47, his 54.

The series of fifteen shows a decided sexual difference. The males range from 146 to 155 and average 151, the females from 160 to 166 and average 163. Conditions are reversed in the subcaudal counts for the females range only from 39 to 46, with 42 as average, while the males range from 50 to 56 with 53 as average.

6. MIDVENTRAL TAIL STRIPE.—None of the Ch'ungan Hsien specimens shows signs of such a stripe.

A few remaining characters, not being especially significant, may be recorded briefly.

The upper labials are uniformly 6, the lower 6 everywhere except on one side of one where they are 7. There is never a trace of postoculars.

The anterior temporals, both of which are in contact with the eye in all but No. 33751, are 2 on a side in twelve specimens; in two the upper one is split into 2 scales on one side, while in a single one the supraocular has absorbed one anterior temporal on both sides. On one side in No. 33751 the lower temporal is excluded from the eye, while on the other it barely touches. The posterior temporals are uniformly 2 on a side in all but one which has a third irregular one on one side. The anal is never divided and the scales are always keeled. In the females the tail occupies from 0.14 to 0.16 of the total, in the males from 0.20 to 0.22. The three largest among the nine females measure from snout to vent 345, 335, and 320 mm., among the six males 272, 237, 217 mm., respectively. In life the scales are highly iridescent and the belly yellowish.

It is hard to say just where Mr. Sowerby's Foochow specimen (Stejneger, 1925) came from. We found this snake only in the highest mountains about Kuatun where it is not uncommon. It is extremely delicate and dies more readily than almost any other snake. Soon after death it dries and hardens in a most unusual way. This drying up might lead one to conclude that it is a secretive burrower but the greatly reduced rostral is anything but a characteristic of burrowing species. It shows not the slightest signs of defensive behavior when handled.

One female contained 7 well-developed eggs, one of which measures approximately 19×7 mm.

ELAPHE

Elaphe schrenckii Strauch

Two specimens from the Western Hills, Peking (Nos. 29388-389), represent this species. Schmidt (1927) reported on nine examples from Hsing Lung Shan, Eastern Tombs, Chihli Province.

Four males from the Eastern Tombs had from 206 to 216 ventrals, while the only one in the new series has 218; four females, 220 to 222, the single new female, 212. These figures indicate that the males from the Western Hills have the greater number of ventrals, while the females from the Eastern Tombs have the higher count. It will be prudent to await further evidence before drawing conclusions. The subcaudal counts of the two series conform well, the male from the Western Hills having $70+$ and the female 68 subcaudals. The Eastern Tombs males averaged 74, the females 69. In other characters these two new specimens conform well with the larger series. The upper labials are 8-8, the fourth and fifth entering the eye in both; the lower, 10-10, the first five pairs in contact with the anterior chin-shields. The preoculars are 2-2 in one, 1-1 in the other; the postoculars, 2-2 in one, and 2-? in the

other. The anterior temporals, 2-2 in both; the posterior, 3-3 in both. The scale formula is 23-23-17 in one, 23-23-19 in the other. The male measures 1540 mm. from snout to vent; the tail occupies 0.15+ of the total length. The female has been skinned so its present measurement of 1600 mm. to the vent is inaccurate. There are 8+12 pairs of black cross-bands on the body and tail, respectively, in one, and 9+10 on the other. These figures are only approximate because the bands are irregularly arranged and paired.

Elaphe carinata Günther

Twenty-five specimens, twenty-two from Ch'ungan Hsien (Nos. 33617-621 and 34296-312), two from Futsing (Nos. 33958-959), and one from Hok'ou (No. 35075) represent this species.

Schmidt (1927) reported on two examples from Yunnan. Boulenger (1899) and Stanley (1914) give Kuatun records.

The present lot is in general agreement with former series. Twelve of the Ch'ungan snakes (Nos. 33618-619, 34297-300, 34302-305, 34310 and 34312) have been examined. The upper labials are uniformly 8-8; the lower, 11-11 in six, 10-11 in four, 11-12 in one, and 10-10 in one. The preoculars are 2-2 in one, and 3-3 in one; the postoculars 2-2 in ten, and 2-3 in two. No. 34300 has on either side an extra scale between the postoculars and the temporals. The anterior temporals are 2 on a side in eight, 3 on a side in three, while in the remaining one there are 2 on one side and 3 on the other. No. 33618 has an extra tiny scale inserted between the temporals on the right. Nine specimens have 3 posterior temporals on a side, two have two on one and 3 on the other, while the remaining one has 4 on each side. The scale formula in seven is 23-23-19; in three more it is 23-23-17, while it is 23-23-18, 21-23-17, and 21-23-19 in one each. The anal is divided in all.

One male from snout to vent measures 1357 mm. The largest specimens are skinned and the longest skin measures from tip to tip 2030 mm. In life the snake was undoubtedly shorter than this as the skins are prone to stretch.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 6 | 218-224 | 221 |
| | ♀ | 6 | 216-224 | 221 |
| Caudals | ♂ | 4 | 93-101 | 96 |
| | ♀ | 6 | 84-91 | 90 |
| Tail/Total Length | ♂ | 2 | .20 | .20 |
| | ♀ | 4 | .19 | .19 |

The two snakes from Futsing and the Hok'ou specimen have the numbers of upper labials, pre- and postoculars, and anterior and posterior temporals that occur most frequently in the Ch'ungan series. The lower labials are 11-11, 9-9 and 10-11; the posterior temporals, 3-3 in two, and 2-2 in one. The scale formula in the two Futsing examples is 23-23-19, in the other, 23-23-17. In ventral count there is a decided gap between the two from Futsing (206 and 208) and all the others, the Hok'ou one agreeing with those from Ch'ungan (225). This gap is bridged over by Stejneger's (1907) series of seventeen in which the extremes are 212 and 217. Oshima (1908) gives extremes for seven from Formosa as 211 and 216. A larger number from Futsing would undoubtedly show a lower average than the present Ch'ungan lot. This point is worthy of note.

In the entire series of twenty-five the outer scale-row is smooth. At midbody the second row is more or less faintly keeled in all but three specimens. The keels begin at a point posterior to the middle of the body in these.

On the 29th of July a batch of 12 white, adherent eggs, obviously deposited by this species, was found buried near the loose surface of a pile of soft, decaying bamboo waste lying in a clearing of the high bamboo forests near Kuatun. Three adults were taken at the pile, one of them a female containing 12 well-developed eggs. Three of the eggs taken from the "nest" measured 47×30.5 , 51×29 , and 45×29 mm., respectively.

In Futsing *carinata* seemed to be rare while at Yenping we failed to find it. About Kuatun it was common enough and it also was not difficult to secure on the plateau near Ch'ungan City. Its presence on the Kiangsi side is testified to by the specimen taken there.

E. carinata is decidedly ophiophagous. One specimen had a large *Boiga krapelini* (No. 34519) in its stomach; another had a half-grown *Agkistrodon acutus* and an adult *Zaocys dhumnades*, while a third was taken just after it had swallowed an *Elaphe osborni*. It is docile and easily handled.

***Elaphe kreyenbergi* (Müller)**

Six specimens, all from Ch'ungan Hsien (Nos. 34636-637, 34679-682), represent this species described as *Spaniopholis kreyenbergi* from Pingshiang, Kiangsi Province, by Müller in 1907, and re-described from two Yunnan specimens by Schmidt (1927) as *Elaphe osborni*. *Spaniopholis* was very properly placed in the synonymy of *Elaphe* by Werner, 1923.

Counts and Characters

| A. M. N. H. Nos. | 34636 | 34679 | 34682 | 34637 | 34680 | 34681 |
|-------------------|----------|----------|----------|----------|----------|----------|
| Sex | ♂ | ♂ | ♂ | ♀ | ♀ | ♀ |
| Dorsal scales | 21-23-19 | 21-21-17 | 21-23-17 | 21-23-17 | 21-23-17 | 21-23-19 |
| Ventrals | 223 | 219 | 219 | 217 | 218 | 220 |
| Caudals | 98 | 87+ | 99 | 93 | 86 | 91 |
| Upper Labials | 8-8 | 7-8 | 8-8 | 8-8 | 8-8 | 8-8 |
| Lower Labials | 11-11 | 11-11 | 11-12 | 10-11 | 11-11 | 11-11 |
| Preoculars | 2-2 | 2-2 | 2-2 | 2-2 | 2-2 | 2-2 |
| Postoculars | 2-2 | 2-2 | 2-3 | 2-2 | 2-2 | 2-2 |
| Anterior | | | | | | |
| Temporals | 2-2 | 1-2 | 2-3 | 2-2 | 2-2 | 2-2 |
| Posterior | | | | | | |
| Temporals | 2-3 | 3-3 | 3-3 | 3-4 | 2-3 | 2-2 |
| Total Length | 587+140 | 388+80+ | 418+103 | 584+133 | 384+88 | 397+97 |
| Tail/Total Length | .19 | .17+ | .20 | .19 | .19 | .20 |

The fourth and fifth upper labials uniformly enter the orbit. Five pairs of labials are in contact with the anterior chin-shields in all but two specimens, both of which are irregular in having 6 labials in contact on one side and the usual 5 on the other. The anal is always divided. The outer row of scales is never keeled. At midbody the second row is smooth in one snake but weakly keeled in the rest.

Schmidt's color description is that of a young example. The present series agrees in general but no two individuals are alike. The markings vary greatly in comparative intensity. The adult anteriorly is mottled brown and black; posteriorly it is uniform brown. Traces of the juvenile pattern may be detected.

I found one of the specimens still alive in the stomach of a large *E. carinata*. The latter was taken in a high bamboo forest near Kuatun. Two others I caught well above Kuatun village on a grass- and bamboo-covered ridge. They were docile and did not bite when handled. One stomach contained frog and another skink remains, while a third held the half digested body of a water-snake (*Natrix percarinata*).

Schmidt's types of *E. osborni* have been examined and there can be no doubt that his form is essentially the same as the Fukien one here described. The Yunnan specimens have somewhat fewer subcaudals, 77 and 79, but in this character Müller's three Kiangsi specimens are exactly intermediate. The differences between the known specimens do not justify geographic subdivision.

This identification disposes of Schmidt's supposition that *osborni* might be identified with *Coluber walli* Werner, as Werner's type has lately been examined by Smith who identifies it as *Elaphe erythrura*.

Now that adults are known, *Elaphe kreyenbergi* proves to be a relative of *E. carinata* rather than of any other Asiatic species of the genus. There is striking resemblance in shape and color of the head, and marked similarity in general coloration of the adult. It should not be forgotten that both species eat other snakes.

***Elaphe mandarina* (Cantor)**

Three specimens (Nos. 33735, 34504-505) were secured at Kuatun.

Schmidt (1927) has reported on two specimens from Szechwan and one bought in Anhwei. Stanley reported it from Fukien in both 1914 and 1916.

The present specimens agree well with those already recorded.

Counts and Measurements

| A. M. N. H. Nos. | 33735 | 34504 | 34505 |
|---------------------|----------|----------|----------|
| Sex | ♂ | ♂ | ♂ |
| Dorsal Scales | 23-23-19 | 23-23-19 | 23-23-19 |
| Ventrals | 215 | 214 | 215 |
| Caudals | 72 | 72 | |
| Upper Labials | 7-7 | 7-7 | 7-7 |
| Lower Labials | 9-9 | 8-8 | 9-9 |
| Preoculars | 1-1 | 1-1 | 1-1 |
| Postoculars | 1-1 | 2-2 | 2-2 |
| Anterior Temporals | 2-2 | 2-3 | 2-2 |
| Posterior Temporals | 3-3 | 2-2 | 3-3 |
| Total Length | 635+144 | 900+205 | 868+? |
| Dorsal Markings | 25+9 | 24+10 | 28+7+ |
| Tail/Total Length | .185 | .185 | |

The anal is divided in all.

One stomach contained balls of short gray (rodent?) hair.

The smallest snake was found crawling over one of a group of vine-grown boulders strewn in an open area in the forests near Kuatun at San Chiang. It was slow and deliberate in its movements and quite docile.

***Elaphe porphyracea porphyracea* (Cantor)**

Fourteen specimens, twelve from Ch'ungan Hsien (Nos. 33731-732, and 34494-503), one from Yenping (No. 33489), and one from Futsing Hsien (No. 34101), represent this species.

Schmidt (1927) reported on two Hainan specimens. Boulenger (1899) recorded four Kuatun examples, while Stanley lists "four specimens from Taipingfu, Chekiang and Fokien" in 1914, and two from Fukien again in 1916. Van Denburgh recorded it from Formosa in 1909.

The characters of the twelve Ch'ungan examples are as follows.

The upper labials are always 8-8; the lower are 10-10 in nine, 9-10 in two, and 9-9 in one. The preoculars are uniformly 1-1, the postoculars 2-2 in eleven, and 1-2 in one. The anterior temporals are 1-1 in all, the posterior, 2-2 in all but one in which they are 2-3. The scale formula is always 19-19-17 and all the anals are divided. The three largest males from snout to vent measure 733, 723, and 715, the females 742, 715, and 704 mm., respectively. There are ten saddles anterior to the vent in seven, 9 in four, and 11 in one example, while on the tail all the specimens have 3 except one which has 4.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 6 | 189-207 | 196 |
| | ♀ | 6 | 199-204 | 202 |
| Caudals | ♂ | 6 | 59-66 | 62 |
| | ♀ | 6 | 64-69 | 66 |
| Tail/Total Length | ♂ | 6 | .16-.18 | .163 |
| | ♀ | 6 | .16-.17 | .168 |

The upper labials, oculars, and temporals in the two remaining specimens, both males, are regular. The Yenping snake has 9, the Futsing 10, lower labials on a side. The ventral and caudal counts, proportionate tail-length, and body and tail saddles are as follows, the figures for the Yenping specimen coming first: 198 and 192, 65+ and 64, .17+ and .18, 11+4 and 9+3.

One stomach contained the remains of a small mammal.

I have carefully studied the series from Fukien, Hainan, and Yunnan, and come to the following conclusions.

1.—Schmidt's new subspecies, *pulchra*, described in 1927, is perfectly good, although it is distinguished by its color pattern rather than by a low ventral count. This means that A. M. N. H. Nos. 21065-21067 from Tengyueh listed by him as typical *porphyracea* really belong under *pulchra*, their high ventral count notwithstanding. This disposes of Werner's 1926 criticism on the grounds of his Yunnan material having a great range in ventral count. He fails to describe the color pattern before him so it is impossible to say what new light his large series might shed on this difficult problem.

The subspecies *pulchra* is distinguished by (1) a series of 12 to 15 narrow, black and white bordered links laid across the dorsum anterior to the vent, descending to the ventrals on either side and enclosing an island of color, matching or nearly matching the ground color. These links, disposed at regular intervals, are as wide as two or three scales are long, both anteriorly and posteriorly, the interspaces of ground color always being much wider than the links. (2) Two black, longitudinal dorsolateral lines that arise behind the seventh to tenth link are at first discontinuous but finally become complete and extend to the end of the tail. The ground color is grayish fawn.

The young have the usual sharply defined black blotches instead of the weaker ones of the adult.

2.—The Fukien and Hainan specimens do not even approach the Yunnan form in pattern. The dorsal markings are for the most part transverse blotches rather than links, being on the average more round in form and almost lacking the strongly contrasted black and white borders. The blotches, 9 to 11 in number, extend downward to, or almost to, the ventrals, cover the length of five or six scales (only three or four in three exceptional cases out of fifteen) on the neck, but only two to four before the vent, and are as wide as or wider than the interspaces on the neck, but not nearly so wide on the posterior part of the body. The pair of dorsolateral black bands extends along the entire length of the body and tail, being full and strong in all the Fukien specimens, weaker in the Hainan ones. The ground color is distinctly reddish rather than grayish fawn, and the pattern in the young is sharply defined as in *pulchra* but exhibits most of the differences of the adults. I seem to remember that in life one juvenile specimen taken near Kuatun had a yellowish ground color but no sign of such is any longer evident.

3.—So far the matter is cleared up, but the difficulty arises with Wall's description of a Burmese specimen with 14 to 17 blotches covering the length of six to eight scales anteriorly but decreasing in width toward the tail. Moreover, on the neck the blotches are described as wider than the interspaces, much less so posteriorly, and at midbody a pair of narrow longitudinal lines arise. To make matters worse he finds only a dull white border to the blotches. His specimens agree with the Hainan and Fukien series in (1) width of blotches, (2) spacing of same, (3) outline of blotches; with *pulchra* in (1) number of blotches, (2) restriction of longitudinal lines to the posterior part of the body.

I see nothing to do but await adequate description of new material. It is highly probable that the form from southeastern China deserves subspecific distinction but with only incomplete description of Indian specimens it is impossible to form a definite idea of its coloration.

Elaphe rufodorsata (Cantor)

One hundred and thirty-six specimens, eleven from Peking (Nos. 29370, 29373, 29376-380, and 29382-385), sixty-three from the Western Hills, Peking, (Nos. 29405-407, 29409-411, 29413-421, 29423-425, 29427-429, 29431-434, 29436-444, 29447-452, 29454-457, 29459-463, 29465, 29467, 29470, 29483-4, 29486, 29492-7, and 29499-500), thirty-six from Tsinan, Shantung Province (Nos. 29650-685), and twenty-six from the Tsinan region (Nos. 29701-716, 29720, and 29733-741), represent this species.

Schmidt (1926) reported on thirty-five examples from Anhwei Province. In general there is very close agreement between the two lots, the only significant difference lying in the slightly higher ventral count of the northern snakes, Schmidt's males averaging but 166 and his females only 177 ventral plates.

Twenty-four specimens have been examined, twelve from Chihli, (Nos. 29376, 29379, 29383, 29385, 29405, 29407, 29413, 29415, 29484, 29486, 29493, and 29495), and twelve from Shantung (Nos. 29662, 29673, 29682, 29702, 29705-706, 29710, 29714-716, 29734, and 29739) with results as follows. The upper labials are 7-7 in nineteen, 7-8 in two, 8-8 in Nos. 29376 and 29734, and 6-7 in one; the lower, 10-10 in seventeen, 9-10 in six, and 10-11 in one. The preoculars are uniformly 1-1 while the postoculars are 2-2 in all but one in which they are 2-3. The anterior temporals are always 2-2, the posterior, 2-3 in twelve, 3-3 in ten, 1-2 in one, and 3-4 in one. There are always 21 rows of scales around the neck and at midbody. No. 29710 has 15 rows just before the vent while all the rest have the usual 17. The anal is entire only in No. 29413.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Chihli Series | | | | |
| Ventrals | ♂ | 6 | 166-173 | 170.5 |
| | ♀ | 6 | 181-187 | 184.5 |
| Caudals | ♂ | 6 | 56-65 | 60.3 |
| | ♀ | 5 | 48-54 | 50.8 |
| Tail/Total Length | ♂ | 6 | .18-.21 | .192 |
| | ♀ | 5 | .15-.15 | .15 |
| Shantung Series | | | | |
| Ventrals | ♂ | 6 | 173-178 | 174.7 |
| | ♀ | 6 | 181-185 | 183.3 |
| Caudals | ♂ | 4 | 53-63 | .595 |
| | ♀ | 5 | 51-54 | .528 |
| Tail/Total Length | ♂ | 4 | .19-.20 | .195 |
| | ♀ | 5 | .15-.16 | .154 |

Eleven females contained 4 to 21 eggs, averaging 12.4 apiece. One fully developed embryo measured 212 mm. from snout to tip of tail, the tail occupying 0.20 of this length.

Six stomachs contained remains of frogs, four of non-spinous loaches.

Elaphe dione (Pallas)

Thirty-six specimens, five from Peking (Nos. 29371-372, 29374-375 and 29381), twenty-six from the Western Hills, Peking, (Nos. 29404, 29408, 29412, 29422, 29426, 29430, 29435, 29445-446, 29453, 29458, 29464, 29466, 29468-469, 29479-482, 29485, 29487-491, and 29498), four from the Tsinan region, Shantung Province, (Nos. 29717-718 and 29722-723), and one from Tsinan (No. 29742), represent this species.

Schmidt's (1927) report included sixty-four examples of this widely distributed snake from Chihli, Shansi, and Inner Mongolia. The present series agrees well with his as the following figures compiled from an examination of thirteen specimens, Nos. 29371-372, 29374-375, 29381, 29488, 29490-491, 29717-718, 29722-723, and 29742, show.

The upper labials are 8-8 in eleven, 8-9 in one, and 8-? in a damaged male; the lower, 11-11 in nine, 11-12 in two, 10-11 in one, and 12-12 in No. 29717. The pre- as well as the postoculars are without exception 2-2. The anterior temporals are 2-2 in nine, 2-3 in three, and 3-5 in a very irregular specimen; the posterior, 4-4 in seven, 3-3 in four, and 3-4 in two. The scale formula is 25-25-19 in nine, 27-27-19 in two, 27-27-21 in one, and 23-25-19 in one.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------------------|-----|---------------------|----------|----------|
| Series from Peking and Region | | | | |
| Ventrals | ♂ | 4 | 184-194 | 187.5 |
| | ♀ | 4 | 193-205 | 198.2 |
| Caudals | ♂ | 3 | 70-77 | 73 |
| | ♀ | 4 | 61-69 | 63.7 |
| Tail/Total Length | ♂ | 3 | .19-.21 | .20 |
| | ♀ | 4 | .17-.18 | .175 |
| Series from Tsinan and Region | | | | |
| Ventrals | ♂ | 1 | 183 | |
| | ♀ | 4 | 195-204 | 200.5 |
| Caudals | ♂ | 1 | 67 | |
| | ♀ | 4 | 59-64 | 61 |
| Tail/Total Length | ♂ | 1 | .21 | |
| | ♀ | 4 | .16-.17 | .165 |

The three largest females in the entire series measured from snout to vent 900, 845, and 840 mm., the males 820, 780, and 650 mm., respectively. The largest specimen in Schmidt's series was also a female.

One gravid specimen contained 11 well-developed eggs.

Schmidt (1927) described *bimaculata* from three specimens that I secured at Ningkwo, Anhwei Province. No further material is at hand so the validity of this species, based on color characters, can not be checked. It is important that specimens from the Shanghai-Nanking region be secured for comparison with typical *dione* from the North, and the position of *bimaculata* determined.

Elaphe taeniura yunnanensis (Anderson)

Twenty specimens, all from Ch'ungan Hsien (Nos. 33623-626, and 34313-328), represent this species.

Stanley (1914) records the typical form from Fukien but it is of course impossible to tell what he had.

The characters and measurements of the present series follow. The upper labials are 9-9 in sixteen, 8-9 in three, and 10-10 in one; the lower, 12-12 in ten, 12-13 in five, 11-12 in two, and 11-13, 10-12, 13-13 in one each. The preoculars are 2-2 in all, but in two examples there is on each side an extra small scale before the preoculars, while this extra scale occurs four more times but on one side only; the postoculars are regularly 2-2 but in one specimen the second is very minute. The anterior temporals are 2-2 in fifteen, 3-3 in two, 3-4, 2-3, and 1-2 in one each; the posterior, 3-3 in nine, 3-4 in six, 2-3 in three, and 4-5 in two. The scales were counted on the neck, at midbody, and before the anus, and found to be 25-25-19 in eleven, and 23-25-19 in four, while the following combinations occurred on but one snake each: 23-23-19, 25-23-19, 23-23-21, 23-24-19, and 25-27-23. Among twenty specimens, then, thirteen had 25 rows of scales on the neck, fifteen had 25 at midbody, while in all but two there were 19 before the vent, one of these being very irregular with 23. Eighteen anals were divided, one entire, and one damaged. Most of the specimens had been skinned and the three longest skins were from females. The longest of all measured 2212 mm. but had doubtless been stretched considerably.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 7 | 241-252 | 245 |
| | ♀ | 13 | 245-258 | 250 |
| Caudals | ♂ | 5 | 95-109 | 102 |
| | ♀ | 8 | 98-111 | 103 |
| Tail/Total Length | ♂ | 1 | .15 | |
| | ♀ | 2 | .19-.21 | .20 |

On June 28 I secured two specimens, one contained 11 and the other 12 fully developed eggs. Also, on July 11, I got one with 12 well-developed eggs.

A Chinese showed me one of these snakes climbing about in low trees. It remained in them for some minutes and when finally disturbed attempted to escape without descending to the ground. My most reliable field-man, "Da Da," shot a large specimen out of a tree. This was the only snake that "Da Da" had treated in this way and when asked about it declared that the snake when found was far above reach in the

tree and that he had through necessity resorted to the only method of securing it. These snakes are common in the Ch'ungan mountains.

E. t. yunnanensis differs from the typical form in its high ventral count so it is significant to find the average of the present series, 248, following one below that given by Schmidt (1927) for eight specimens, most of which are from Yunnan. The average for fifteen examples of the typical form from Anhwei is only 236.

I have carefully compared specimens from Anhwei, Szechwan, and Yunnan with the Fukien material for differences in pattern but find very little. The blotches of the fore body are smaller and less conspicuous in the Anhwei snakes. However, the Ch'ungan series varies greatly in color pattern and the differences between the series are not constant enough to be relied on.

***Elaphe radiata* Schlegel**

One specimen (No. 35237) was collected at Yuan Kiang, southwest Yunnan Province, by Walter Granger.

This snake, rare in China, had not been previously collected by the Expedition nor did the American Museum possess an example. Wall (1903) gives definite Hongkong records and Mell (1922) reports it from Kwangtung.

The upper labials are 8-8, the fourth and fifth entering the eye; the lower, 10-10, the first 5 pairs in contact with the anterior chin-shields. The preoculars are single, the postoculars 2-2; the anterior temporals, 2-2, and posterior, 3-3. The scale formula is 21-21-17; there are 231 ventrals and 101 caudals. The anal is entire. The total length is 1330 mm., 0.22 of which is taken up by the tail.

At midbody all but the 7 or 8 central rows of scales are smooth, while a short distance before the vent only 1 outer row on either side lacks a keel. Along the neck the keeling is reduced to a bare trace on the mid-dorsal row.

GONYOSOMA

***Gonyosoma melli* (Vogt)**

Four examples, one from Yenping (No. 33456), and three from Ch'ungan Hsien (Nos. 34355, and 34590-591), represent this species.

Schmidt (1927) had a specimen from Yenping which he described as *Gonyosoma caldwelli* in American Museum Novitates No. 157, 1925. He considers *caldwelli* and *melli* distinct on the strength of differences in ventral, caudal, and anterior temporal counts. These differences are practically obliterated by the new series, and *caldwelli* must be placed in

synonymy. Mell's range in ventrals is 212-216, the range in the new series, 213-223, while the type of *caldwelli* has 223. Mell's have from 144 to 148 caudals, the present lot from 129 to 135+. The gap here is very small. The type of *caldwelli* has a damaged tail so its count (108) is unreliable. In the present series the anterior temporals are 2-2 in two, 2-1 and 1-1 in one each. Schmidt gives *caldwelli* anterior temporals as single, while *melli* is described as having 2 on a side. We see that the anterior temporals may be 2-2 or 1-1. The counts and measurements for the present series follow.

| A. M. N. H. Nos. | 33456 | 34355 | 34590 | 34591 |
|---------------------|-----------|----------|----------|----------|
| Sex | ♂ | ♀ | ♀ | ♀ |
| Dorsal Scales | 19-19-15 | 19-19-15 | 19-19-15 | 19-19-15 |
| Ventrals | 217 | 213 | 220 | 223 |
| Caudals | 135+ | 129 | 131 | 135 |
| Upper Labials | 8-8 | 8-9 | 8-8 | 8-8 |
| Lower Labials | 10-11 | 10-10 | 11-11 | 10-10 |
| Preoculars | 1-1 | 1-1 | 1-1 | 1-1 |
| Postoculars | 2-2 | 2-2 | 2-2 | 2-2 |
| Anterior Temporals | 2-1 | 1-1 | 2-2 | 2-2 |
| Posterior Temporals | 2-2 | 3-3 | 2-2 | 2-3 |
| Total Length | 1028+430+ | 670+258 | 291+110 | 347+121 |
| Tail/Total Length | .29+ | .28 | .27 | .26 |

In the two large specimens 7 and 8 scale-rows are feebly keeled but in the two small ones keels can scarcely be detected. The anal is divided in all.

The coloration of juvenile specimens in the present series corresponds closely to that described by Vogt from Kwangtung specimens. The spotted juvenile coloration of this species exhibits the relation between *Gonyosoma* and *Elaphe*.

LIOPELTIS

Liopeltis major (Günther)

Eighty-three specimens, thirteen from Futsing Hsien (Nos. 33960-972), forty-four from Yenping (Nos. 33412-455), and twenty-six from Ch'ungan Hsien (Nos. 33633-638 and 34335-354), represent this species.

Schmidt (1927) reported on two from Futsing, one from Yenping, and one from Anhwei, while Boulenger (1899) lists three Kuatun specimens. Werner (1908) records five from Foochow; Stanley (1914 and 1916) lists Fukien and Chekiang examples. Stejneger (1925) gives Yenping, Foochow and Chekiang records. Mell (1922) says that it is common in Kwangtung. Thus, we see that this snake has long been known from this part of China.

Nineteen specimens have been selected for study, Nos. 33417, 33419, 33425, 33431, 33435-436, 33453, 33633, 33635, 33637-638, 33960, 33962-964, 33967, 33965, 34335 and 34350. The upper labials are 8-8 in eighteen, and 7-8 in one; the lower, 7-7 in twelve, 6-7 in five, 7-8 and 8-8 in one each. The preoculars are always 1-1, the postoculars, 2-2. There is one anterior temporal on each side in all and the posterior temporals are 2-2 in eighteen and 2-3 in one. The scales are 15-15-15 in all. There is only one (No. 33453) in the entire series with an undivided anal. The three largest males measure 713, 710 and 650 mm. from snout to vent, the three largest females 678, 608 and 608 mm., respectively.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 11 | 158-166 | 162 |
| | ♀ | 8 | 161-170 | 167 |
| Caudals | ♂ | 11 | 82-90 | 85 |
| | ♀ | 7 | 76-82 | 80 |
| Tail/Total Length | ♂ | 11 | .24-.28 | .263 |
| | ♀ | 7 | .24-.26 | .250 |

In the field a female containing 8 well-developed eggs was brought in. One measured 29×14 mm., another 30×13.5 mm. A second female held 13 eggs. Of six preserved females three contained 7, one 6, one 4, and one 8 eggs.

L. major obviously lives on earthworms, for remains of such were found in nine stomachs, while five others contained gritty earth. The remaining stomachs were empty.

This snake seemed to be really at home in the Yenping mountain bamboo forests where it was exceedingly abundant. I used to encounter it daily gliding about on the forest floor. It was not very common at Kuatun and we secured two examples on the open plateau in the Ch'ungan City region. It was not rare in Futsing Hsien.

Liopeltis major was never observed to either bite, strike or assume a defensive posture.

MACROPISTHODON

Macropisthodon rudis Boulenger

Sixteen examples, all from Ch'ungan Hsien (Nos. 33650-652, 34506-517, and 34520), make up the series of this species.

Stanley (1914) reports "specimens from North-eastern Fokien" and Werner (1908) records a Foochow example. The upper labials are 7-7 in all but two, each of which has an extra one on one side; the lower,

9-9 in twelve, 9-10 in three, and 10-10 in one. There are regularly 3 preoculars on a side, and in all but two the suboculars are 3-3; in those two they are 2-3. The postoculars are 3-3 in seven, 4-4, 3-4, and 2-3 in three each. The anterior temporals are 3-3 in thirteen, and 2-2 in the rest. The scales are uniformly in 23 rows on the neck and at midbody, in 19 before the vent. The anal is divided in fourteen, and entire in two. The three largest females measure from snout to vent 805, 775, and 770 mm., the largest males 590, 560, and 543 mm., respectively.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 6 | 133-142 | 138.5 |
| | ♀ | 10 | 145-152 | 147.6 |
| Caudals | ♂ | 6 | 54-58 | 55.7 |
| | ♀ | 10 | 45-50 | 46.9 |
| Tail/Total Length | ♂ | 5 | .25-.29 | .27 |
| | ♀ | 8 | .18-.20 | .19 |

In 2 juvenile females the tail occupies but 0.16 of the total, in a single male but 0.19. This is in marked contrast to the condition in the adult.

Mell's (1922) new subspecies *melanogaster* is apparently based on color characters.

A toad was disgorged by one specimen.

Four females held respectively 18, 22, 23, and 25 well-developed eggs.

This snake was found only in the high forests about Kuatun. A large example, when annoyed, threw itself into regular coils, flattening its head, neck, and body until the conspicuous spots stood out boldly and the head, which was drawn back in a most threatening attitude, became arrowhead-shaped. It would make only half-hearted strokes, apparently being satisfied to pose thus. Repeated teasing and handling failed to make it actually bite.

HOLARCHUS

Holarchus chinensis (Günther)

Five specimens, two from Yenping (Nos. 33403-404), one from Ch'ungan Hsien (No. 34656), and two from Hok'ou (Nos. 35055-056), represent this rare snake.

Günther described this species from the mountains north of Kiu-kiang in 1888; Wall (1903) saw two in the Siccawei Museum, Shanghai,

and caught one near that city; Stanley (1916) reported one from Changning, Kiangsi Province; Mell (1922) found it in Kwangtung; and Schmidt (1927) records one from Ningkwo, Anhwei Province, and one from Yunnanfu.

The single female has a decidedly reddish tinge that is lacking in the males. The anal is always entire. The Ch'ungan Hsien specimen was caught in the open country near Ch'ungan City.

Scale Characters and Measurements

| A. M. N. H. Nos. | 34404 | 33403 | 35055 | 35056 | 34656 |
|------------------------|--------|--------|---------|---------|--------|
| Sex | ♀ | ♂ | ♂ | ♂ | ♂ |
| Dorsal Scales | 17-15 | 17-15 | 17-15 | 17-15 | 17-15 |
| Ventrals | 190 | 183 | 173 | 176 | 179 |
| Caudals | 50 | 55 | 58 | 60 | 59 |
| Upper Labials | 8-8 | 7-8 | 7-8 | 7-7 | 7-8 |
| Lower Labials | 8-8 | 8-9 | 8-8 | 7-7 | 9-9 |
| Preoculars | 1-1 | 2-2 | 2-2 | 1-2 | 1-1 |
| Postoculars | 2-2 | 2-2 | 2-2 | 2-2 | 2-2 |
| Anterior Temporals | 1-3 | 1-2 | 1-2 | 1-2 | 2-2 |
| Posterior Temporals | 2-4 | 2-2 | 2-2 | 2-2 | 2-2 |
| Dorsal Cross- bands | 13+4 | 13+4 | 10+4 | 12+4 | 12+4 |
| Length | 512+90 | 364+83 | 470+113 | 481-117 | 200+40 |
| Tail/Total Length | .15 | .18 | .19 | .20 | .17 |

These specimens conform well with those previously described except that Schmidt's Yunnan specimen has the light vertebral stripe mentioned by him. He records its upper labials as 9-9, but I find that they are only 8-8 and appear to be 9-9 because of the badly damaged condition of the head.

This snake seemed to be absent on the Futsing coastal plain as well as in the Kuatun mountains.

Holarchus violaceus (Cantor)

There are three specimens, all from Futsing Hsien (Nos. 33807-809) in the present collection.

Schmidt (1927) reported on two Fukien specimens, one of which came from Yenping, a single individual bought in Anhwei Province, and forty-three from Hainan Island. Boulenger (1894) quotes an Amoy record, Stanley (1914) lists specimens from Fukien, while Stejneger (1925) records a Foochow example.

The three specimens at hand conform well with others. The upper labials are 8-8 in two, and 7-7 in the third, while the lower are 8-8 in one, 7-8 in one, and 7-7 in one. The preoculars are 2-2 in all, the postoculars 2-2 in two, and 2-1 in the third. The anterior temporals are uniformly 1-1, the posterior 2-2 in two, and 2-1 in one. The scale formula is 17-17-15 in the three. In the males there are 156 ventrals while the single female has 160. In the males the caudals are 39, 35, in the female 32. From snout to vent the three specimens measure 459, 419, and 412 mm., the female being the longest. The tail occupies 0.13 of the total in the female and 0.14 in both of the males. The anal is always entire.

This species, common in the south, reaches its northern limit in Fukien.

Holarchus formosanus Günther

Nine specimens, four from Futsing Hsien (Nos. 33810-813), one from Foochow (No. 35199), two from Yenping (Nos. 33410 and 35144), one from Ch'ungan Hsien (No. 33758), and one from Hok'ou (No. 35059), make up the series of this species.

Schmidt (1927) records eight specimens from Hainan as *formosanus hainanensis*. Boulenger (1894) and Mell (1922) have both reported this Formosan snake from Kwangtung while Stejneger (1925) records one from Yenping.

This series agrees well with Formosan snakes. The upper labials are 8-8 in seven, 7-8 in two; the lower, 9-9 in three, 8-9, 8-8, and 7-8 in two each. The preoculars are 2-2 in all, the postoculars, 2-2 in all but one in which they are 1-1. The anterior temporals are 1-1 in seven, and 1-2 in two, the posterior, 2-2 in eight, and 1-2 in one. The anal is always entire. The two largest males measure from snout to vent 525 and 480 mm., the females 467 and 465 mm. The largest specimen, in Schmidt's series of *hainanensis*, is a male. This is also the case in Steindachner's lot of twelve. The male, then, is the larger in this species.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 4 | 159-162 | 161 |
| | ♀ | 5 | 164-168 | 167 |
| Caudals | ♂ | 4 | 46-50 | 48 |
| | ♀ | 4 | 42-45 | 44 |
| Tail/Total Length | ♂ | 4 | .18-.19 | .185 |
| | ♀ | 4 | .14-.16 | .152 |

Schmidt (1927) was lead by the high ventral count of Boulenger's Swatow specimen (173) to suggest that it is the Hainan form that inhabits the mainland. A glance at the above table will show that the line between the two forms must fall south of the localities of our specimens. Unfortunately, Mell and Vogt do not give their scale counts. The Fukien specimens closely agree with the Formosan lots. Schmidt gives 164.4 as the average of eight from Formosa. The present series of nine averages 164.2.

This snake is common, though not abundant, on all the plains, plateaus and hilly regions of the country worked. It was not seen in the high Ch'ungan forests.

***Holarchus musyi* (Roux)**

Figure 14

Nine specimens, all from Ch'ungan Hsien (Nos. 33753-757, and 34592-595), represent this species.

The upper labials are uniformly 6-6, the third and fourth entering the eye; the lower, 7-7 in five, 6-6 and 6-7 in two each, with the first 4 on each side in contact with the anterior pair of chin-shields in six, three on one side, and four on the other in the remaining three. The preoculars are 1-1 in eight, 2-2 in one; the postoculars, 2-2 in six, 1-2 in two, and 1-1 in one. The anterior temporals are 2-2 in eight, and 1-2 in one; the posterior, 2-2 in five, 1-1 in three, and 1-2 in one. If the anterior temporals are considered to be 1-1 then the upper labials must be taken as 7-7 instead of 6-6. The scales are in 15 rows throughout, the anal always divided. The three largest males measure, from snout to vent, 508, 497, and 480 mm., respectively, the largest females 452, 405, and 330 mm. In five out of nine there are 7 cross-bands on the body, 1 over the vent, and 2 on the tail. Expressed as a formula the figures for all nine are 7-1-2 in five, 9-1-2 in two, 9-0-2 and 8-1-2 in one each. Along either side of the ventrum is a single row of dark spots between which lies a conspicuous, broken line of bright red.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 5 | 170-172 | 171 |
| | ♀ | 4 | 172-182 | 177 |
| Caudals | ♂ | 5 | 36-40 | 38 |
| | ♀ | 4 | 27-34 | 32 |
| Tail/Total Length | ♂ | 5 | .15-.16 | .154 |
| | ♀ | 4 | .11-.13 | .120 |

These snakes were found only in the Ch'ungan Hsien mountains of the Kuatun neighborhood where they were not uncommon.

Roux (1919) described this species from a single Fukien specimen with 172 ventrals and 44 subcaudals. He gives the total length as 450 mm., and that of the tail as 70 or .155 of the total, calling the specimen a female. The high subcaudal count as well as the long tail indicate, however, that he had a male. If he really did sex his specimen correctly

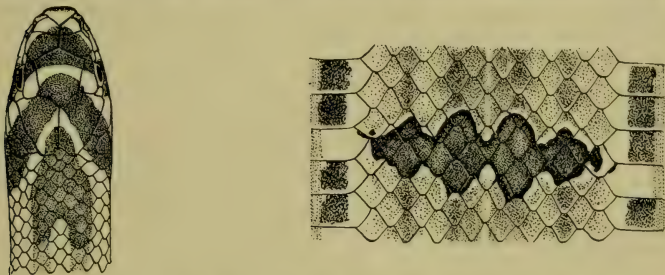


Fig. 14. *Holarchus musyi* (Roux).

Color pattern of head and section of body, A. M. N. H. No. 33756, three times natural size.

it has 10 more subcaudals than any one of my four females, but I am inclined to believe, since the rest of the description, except the omission of the red on the ventrals, fits so well that his was a male with a high subcaudal count.

The Formosan representative of this form was described by Van Denburgh in 1909 as *Oligodon ornatus* with 161 ventrals, 37 subcaudals, and a tail .148 of the total, so it may be considered a male. In 1910 Oshima re-described this snake also from Formosa, as *Holarchus torquatus konishii* with 159 ventrals, 35 subcaudals, and a tail .125 of the total length. His type was probably a female. His second specimen had 172 ventrals, 30 subcaudals, and a tail only .064 of the total. His data are here probably at fault. Steindachner (1914) records nine examples and gives their ventrals as 159–173; subcaudals 32–39, but does not separate the sexes. The gap between the mainland and island form is small and consequently their relationship must be close. Only Oshima mentions the red of the ventral plates.

Holarchus (species?)

No. 29943 is a partly digested snake taken from the stomach of a large *Dinodon flavozonatum* caught in Ch'ungan Hsien.

The scales at midbody and just before the anus are in 15 rows, all but the outer 2 on either side keeled. The anal is entire and there are 51 subcaudals, all divided. The tail ends in a sharp spine. The specimen is a female.

The dorsum is uniform red-brown, broken only by scales marked with black arranged so as to suggest numerous narrow, broken cross-bands. The ground color extends on to the tips of the ventrals, the rest of which are very pale yellow. Over the ventrum there is a sparse sprinkling of dark spots very variable in size and irregular in outline.

The stomach contained a slug.

CALAMARIA

Calamaria septentrionalis Boulenger

Two examples, one from Yenping (No. 33411), and one from the Kuatun region (No. 34635), represent this species. In addition there are nine specimens from Nananfu, Kiangsi Province, presented by Thomas S. Crossley.

Schmidt (1927) records eight Anhwei specimens. Boulenger (1899) lists a Kuatun example; Stanley (1914), "10 specimens from Wuhu, Weichow, and Fokien," and Stejneger (1925), one from Foochow. Werner (1924) gives a new Kiangsi record.

The entire series is quite regular. There are 4 upper and 5 lower labials; 1 pre- and 1 postocular, and 13 rows of scales in the two Fukien snakes. The figures for the ventral and subcaudal counts and the proportionate tail-length in the Yenping female are 176, 9, and 0.037; in the male from the Kuatun region, 162, 16, and 0.065. From snout to vent the Yenping specimen measures 334 mm., the other only 185 mm.

Six of the Nananfu specimens have been studied (Nos. 31770, 31772-773, and 31775-777). With the exception of one in which the mental on one side is irregularly shaped and the lower labials reduced to 3, these six agree with the Fukien specimens. The figures for the ventral and caudal counts, and the proportionate tail-length are as follows: 160, 158, 153; 15, 16, 17; 0.071, 0.063, 0.079, respectively, in the three males; 174, 171, 174; 8, 9, 8; 0.032, 0.035, 0.032, respectively, in the three females. The females measure from snout to vent 350, 307 and 240 mm., the three males 118, 118 and 105 mm., taken in order of size. The females are uniformly the larger.

This snake must be rare about Yenping. It was unknown to the native collectors immediately at Kuatun but seemed to be found not rarely in the lower mountains several miles away. Boulenger's Kuatun

specimen was likely brought from some distance as was the one recorded here as being from the "Kuatun region."

ENHYDRIS

Enhydriis plumbea (Boie)

Eighty specimens, fifty-one from Futsing Hsien (Nos. 33891-33931 and 33933-942), three from Foochow (Nos. 35196-198). Twenty-one from Yenping (Nos. 33273-293), three from Kienning (Nos. 35138-140), and two from Ch'ungan Hsien (Nos. 33706-707) represent this species. Kienning is near Yenping.

Schmidt (1927) records one hundred and twelve examples from Hainan, one from Yenping, and one bought in Anhwei. Stanley (1914) lists specimens from Fukien, while Stejneger (1925) records two from Futsing Hsien, six from Foochow, one from Kuliang near Foochow, and one from Yenping.

The remarkable uniformity in this species is shown by Schmidt's series as well as the present one. His males averaged 129, his females 128 ventrals, as do those selected from the present series.

Eleven specimens (Nos. 33273, 33282, 33285, 33288, 33706-707, 33892, 33904, 33906, 33921, and 35140) have been counted and measured. The upper labials are 8-8 in ten, and 7-8 in one; the lower, 10-10 in nine, and 10-11 in one. The preoculars are always 1-1, the postoculars, 2-2. The anterior temporals are 1-1, the posterior 2-2, in all. The scale formula is invariably 19-19-17. The three largest males of the entire series measure from snout to vent 358, 324, and 310 mm., the three largest females 378, 361 and 340 mm.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 7 | 127-130 | 129 |
| | ♀ | 4 | 127-128 | 128 |
| Caudals | ♂ | 7 | 37-41 | 38 |
| | ♀ | 3 | 31-34 | 33 |
| Tail/Total Length | ♂ | 7 | .13-.14 | .136 |
| | ♀ | 3 | .11-.13 | .117 |

Eight females contained from 2 to 9 eggs, the average being 5.9. Schmidt records a range of from 4 to 11 for the Hainan series. The gravid females were, with a possible exception, collected at Yenping in May.

While collecting these snakes I was able to detect no difference in

either habits or habitat. Both may be found at night in the flooded fields and irrigation ditches throughout the region worked, with the exception of the Kuatun mountain district, and both are abundant. Examination of the stomachs has shown that *plumbea* lives on an amphibian, *chinensis*, a fish diet. Seven stomachs of the present series of *plumbea* contained frog remains and the rest were empty or nearly so, while fishes were found in the four *chinensis* stomachs that held identifiable remains. Schmidt found nothing but fish remains in *chinensis*, and frog remains in *plumbea* stomachs. These two snakes are enabled to inhabit the same fields through an avoidance of competition in feeding, one preying on fish, the other on frogs.

As Schmidt suggests, the Kuatun range effectually cuts *plumbea* off from the Kiangsi plateau. It was much rarer than *chinensis* even on the Ch'ungan side of these mountains. The Ch'ungan Hsien specimens were taken near Ch'ungan City.

***Enhydris chinensis* (Gray)**

Seventy-five specimens, thirty-six from Futsing Hsien (Nos. 33855-890), three from Foochow (Nos. 35193-195), twenty from Yenping (Nos. 33253-272), fourteen from Ch'ungan Hsien (Nos. 33694-705 and 34487-488), and two from Hok'ou (Nos. 35085-086), represent this species.

Schmidt (1927) reported on forty-six from Hainan, and two from Fukien. Stanley (1914) listed "numerous examples from Fukien" and in 1916 recorded it from Changning, Kiangsi Province. Stejneger (1925) has one example from Futsing Hsien and one from Foochow.

There is little variation within this series and it agrees well with the Hainan lot, except for a slightly higher number of ventrals and caudals. Fifteen specimens have been selected for study, Nos. 33254, 33259, 33260, 33269, 33697-689, 33704-705, 33857, 33860, 33870, 33885, and 34085-086. All of these have 7 upper labials on both sides, while the lower are 10-10 in eight, 9-10 in three, and 9-9, 10-11, and 11-11 in one each. The preoculars are always 1-1, and the postoculars 2-2; the anterior temporals always 1-1, the posterior, 2-2. The scale formula is 23-23-21 in six, 23-23-19 in five, and 23-25-19, 25-23-21 and 25-23-19 in one each. Among the entire series of seventy-five the three largest females measure from snout to vent 500, 480 and 480 mm., respectively, the largest males 390, 384 and 380. Thus, we see that the females are decidedly the larger.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 7 | 146-151 | 149 |
| | ♀ | 8 | 141-146 | 143 |
| Caudals | ♂ | 6 | 46-50 | 48 |
| | ♀ | 8 | 37-42 | 40 |
| Tail/Total Length | ♂ | 6 | .15-.16 | .157 |
| | ♀ | 8 | .13-.14 | .132 |

One stomach contained the remains of a small carp, one of a goldfish (*Carassius*) or a carp (*Cyprinus*), one of a small fish (*Macropodus viridiflavus*), and another an entire specimen of *Erythroculter aokii*. For a discussion of the feeding habits of *chinensis* and *plumbea* see *plumbea*.

Ten gravid females from Yenping held from 3 to 7 eggs but averaged only 4.7 apiece, while five from Ch'ungan Hsien averaged 8.6 and held from 5 to 13. Two Futsing Hsien specimens held respectively 4 and 5 well-developed embryos, 2 of which measured from snout to tip of tail 155 and 165 mm. It is hard to explain why the snakes from the higher altitude produce the greater number of young. The gravid females from Yenping were taken, with a possible exception, in May, those from Ch'ungan Hsien, in June. Since none of these contained well-advanced embryos we can get a good idea of the breeding time. The two Futsing females with the advanced embryos were collected the last week in August or later. It should be noted that only two among thirty-six were gravid, the rest probably being spent.

No. 34488 was brought in by a Kuatun man who said that it was taken there, but this is doubtful for it was probably brought up from the plateau some miles distant. If it does occur in these highest mountains certainly it is exceedingly rare there. All the other Ch'ungan Hsien specimens came from the plateau near Ch'ungan City.

BOIGA***Boiga sinensis* Schmidt**

Four specimens, one from Futsing Hsien (No. 34100), two from Ch'ungan Hsien (Nos. 34518-19), and one from Ch'ien-shan Hsien, Kiangsi Province (No. 34521), represent this species described by Schmidt in 1927 from a Fukien specimen. Ch'ien-shan Hsien is just across the provincial line from Ch'ungan Hsien.

The third, fourth, and fifth labials enter the eye in all, and in addition, the sixth does so on one side in No. 34518. The first 4 pairs of lower labials are in contact with the anterior chin-shields in three specimens, the first 5 in the remaining one.

Characters and Measurements

| A. M. N. H. Nos. | 34100 | 34518 | 34519 | 34521 |
|-------------------|----------|----------|----------|----------|
| Sex | ♂ | ♂ | ♀ | ♀ |
| Dorsal Scales | 25-21-15 | 25-21-15 | 25-21-17 | 25-21-17 |
| Ventrals | 235 | 237 | 234 | 230 |
| Caudals | 136 | 127 | 130 | 136 |
| Upper Labials | 9-9 | 9-10 | 9-? | 9-10 |
| Lower Labials | 12-12 | 12-12 | 12-? | 13-13 |
| Preoculars | 2-2 | 2-2 | 2-2 | 2-2 |
| Postoculars | 2-2 | 1-2 | 2-2 | 1-2 |
| Length of Body | 740 | 595 | 1000 | 748 |
| Length of Tail | 268 | 179 | 330 | 263 |
| Tail/Total Length | .26 | .23 | .25 | .26 |

One of these snakes disgorged a bird. No. 34519 was taken from the stomach of a half-grown *Elaphe carinata*. *B. sinensis* is very docile, only one of two specimens handled attempted to bite and that one did not strike. They are not readily secured but evidently frequent all the wooded hills and mountains of the region worked.

The present series bridges the gap between the ventral count of mainland *sinensis* and Formosan *kræpelini* with its range of 236-250 compared to that of 230-237 in *sinensis*. However, the average in ten Formosan examples, 240, is much higher than 233, the average of the five mainland specimens. The gap between the subcaudal counts stands unbridged though somewhat reduced: *sinensis* 127-136, *kræpelini* 140-154. Larger series may bridge this subcaudal gap and make it necessary to give *sinensis* subspecific rank.

***Boiga multimaculata* (Boie)**

One specimen, a male, from Futsing Hsien (No. 34103) represents the species. Schmidt's (1927) report includes twenty-three specimens from Hainan.

Stanley (1916) records *multimaculata* from Changning, Kiangsi Province. I found it abundant on Hainan (Schmidt, 1927) and, in addition to Schmidt, Barbour (1909), Stanley (1917), and Smith (1923) have all reported it from there. Mell (1922) found it in Kwangtung. It is not surprising that it is rather rare as far north as Futsing.

The counts and measurements are quite regular. There are 8 upper, and 11 lower labials: 1 pre- and 2 postoculars. The anterior temporals are 2-2, the posterior 3-3. The scale formula is 19-19-15. Two rows drop out just posterior to the middle of the body, however. There are 197 ventrals and 84 subcaudals, while the tail occupies 0.20 of the total

length. The vertebral row of scales is enlarged. From snout to vent the specimens measures 398 mm.

When annoyed this specimen coiled symmetrically and struck with clock-like regularity just as the Hainan specimens had done.

AMBLYCEPHALUS

Amblycephalus boulengeri Angel

Figure 15

One specimen, No. 23505, was collected at Luanshikkao, near Wansien, eastern Szechwan Province, by Walter Granger in September, 1921. It was taken at an altitude of 3000 feet. In his 1927 report, Schmidt recorded this as *chinensis*. I have, with the new Fukien series at hand, gone over the description of all the Chinese species and am convinced that he was mistaken. In *chinensis* the loreal does not reach the eye as in *boulengeri* and the upper labials are 8-8 only in the one Chinese species. There are further differences between *chinensis* and *boulengeri*.

The lower labials in No. 23505 are 9-10 with 4 in contact with the anterior chin-shields on one side and 5 on the other. This character alone

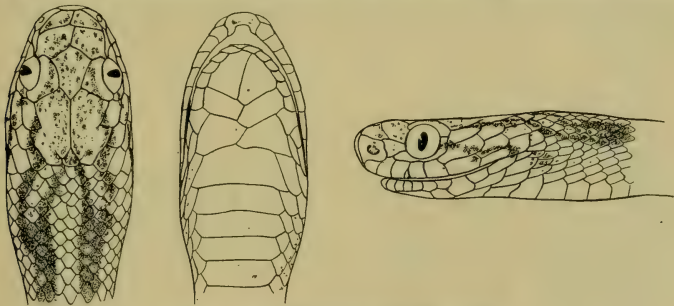


Fig. 15. *Amblycephalus boulengeri* Angel.

Dorsal, ventral, and lateral views of head, A. M. N. H. No. 23505, four times natural size.

might serve to distinguish it from all other Chinese forms but unfortunately in the description of the type of *boulengeri* the lower labial count is not given. Moreover, the first 6 on either side are imbricate, a condition not found in the other species.

No. 23505 is a female with 177 ventrals, 63 subcaudals, and 15 rows of smooth scales. The distinct subocular and supraocular unite behind the eye above the center. The loreal narrowly enters the eye and the upper labials are 8-8.

Amblycephalus kuangtungensis Vogt

Figure 16

Five specimens, all from Ch'ungan Hsien (Nos. 33748, 34600, 34603, 34605, and 34608), and a lot of embryonic material (No. 34609), represent this species.

Characters and Measurements

| A. M. N. H. Nos. | 33748 | 34600 | 34603 | 34605 | 34608 |
|------------------|-------|-------|--------|-------|-------|
| Sex | ♂ | ♂ | ♀ | ♀ | ♀ |
| Dorsal Scales | 15 | 15 | 15 | 15 | 15 |
| Ventrals | 185 | 182 | 183 | 186 | 188 |
| Subcaudals | 83 | 88 | 72 | 76 | 77 |
| Upper Labials | 7-7 | 7-7 | 7-7 | 7-7 | 7-7 |
| Lower Labials | 8-9 | 8-8 | 7-8 | 8-8 | 7-8 |
| Labials Enter | | | | | |
| Orbit | Yes | No | Yes-No | Yes | No |
| Loreal to Eye | No | No | No | No | No |
| Anterior | | | | | |
| Temporals | 2-2 | 2-2 | 2-2 | 2-2 | 1-2 |
| Posterior | | | | | |
| Temporals | 3-3 | 3-3 | 3-3 | 3-3 | 3-3 |
| Total Length | 342 | 580 | 568 | 492 | 640 |
| Tail/Total | | | | | |
| Length | .23 | .25 | .22 | .22 | .23 |

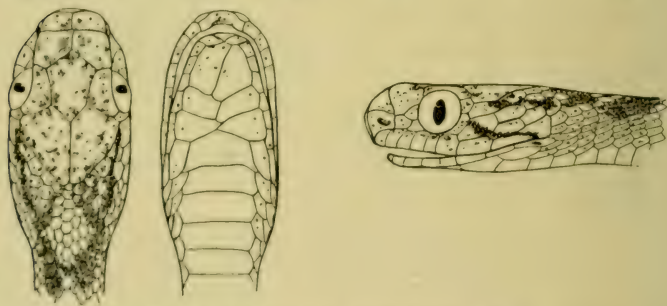


Fig. 16. *Amblycephalus kuangtungensis* Vogt.

Dorsal, ventral, and lateral views of head, A. M. N. H. No. 34600, four times natural size.

The anal is always entire and the chin-shields in three pairs. The scales are smooth and the vertebral row is slightly enlarged in two, not enlarged in three specimens. The entire top of the head is profusely speckled with black in varying degrees of intensity but there is never a

sign of the clean-cut conspicuous light margin to this black so constant in *stanleyi*.

The description of *kuangtungensis* fits this series quite well as might be expected from the proximity of Fukien to Kwangtung.

On August 23 four white eggs containing well-developed embryos were brought in (No. 34609). One egg measured 25×15 mm., while one embryo was just 157 mm. long.

The docility of these snakes has been referred to under *stanleyi*. Like that species they were taken in the high Kuatun mountains.

Amblycephalus niger, new species

Figure 17

TYPE.—A. M. N. H. No. 22703; ♀; Yunnanfu, Yunnan Province, China; John Graham.

DIAGNOSIS.—An *Amblycephalus* with a black tail and a large amount of black on the dorsum. The loreal is excluded from the eye, and at midbody 7 rows of scales are keeled.

DESCRIPTION OF TYPE.—Rostral as broad as deep; internasals in contact with loreal and half as large as prefrontals which enter the orbit; frontal without its posterior projection about as broad as deep, much shorter than, but about as wide as parietals which are as long as their distance from tip of snout. Loreal widely

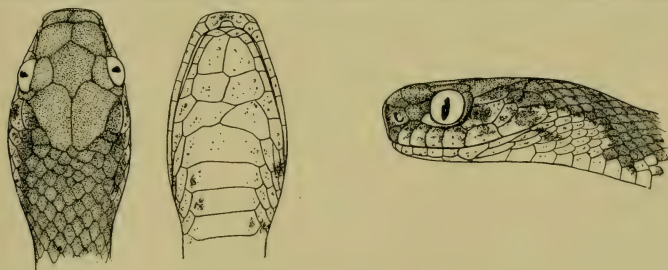


Fig. 17. *Amblycephalus niger*, new species.

Dorsal, ventral, and lateral views of head of type, four times natural size.

separated from eye by a distinct preocular and enlarged end of a subocular; a long, narrow scale separates eye from upper labials; anterior temporals 2, separated from eye by narrow scale below, wider one above; posterior temporals 3-3. Upper labials 7-7; lower, 7-7, first pair narrowly in contact behind mental; first 4 in contact with anterior chin-shields which are longer than broad; second pair slightly broader than long, third much broader than long; diameter of eye equals half interorbital space. Scales in 17 rows, vertebral row not enlarged; ventrals 165; subcaudals 64; anal entire; total length 502 mm., 0.22 occupied by tail.

The solid black of the top of the head extends down about to the loreal and lower anterior temporal where it begins to break into profuse spots which in turn become less profuse until, on the upper labials, they are sparse. On the lower labials and chin-shields the spots are reduced to a little scattered speckling. The neck and back are black but the black is broken on the sides by very irregular, light areas extending upward from the light ventrals, and suggesting the remnants of bands that have all but disappeared. Toward the tail these light areas are much more marked than they are anteriorly. The belly is light except for very irregular, sparse mottling mostly in the form of spots or narrow intrusions of the black of the dorsum. The tail is uniformly black with a little light mottling on the first 10 to 12 subcaudals.

The type is unique and was reported by Schmidt in 1927 as *chinensis*.

A. niger differs markedly in color from all the Chinese species. In addition it is distinguished from all but *yunnanensis* and *stanleyi* by its keeled scales. In *yunnanensis* the loreal reaches the eye and the vertebral row is enlarged, so from this species *niger* is amply distinct. The low caudal count in *stanleyi* separates it not only from *niger* but the rest of the Chinese species as well.

Amblycephalus stanleyi Boulenger

Figure 18

Eight specimens, all from Ch'ungan Hsien (Nos. 34597-599, 34601-602, 34604 and 34606-607), represent this species which was described from Kuatun by Stanley in 1916 as *sinensis*. Nos. 34492, and 34610-11 are sets of embryonic material also from Ch'ungan Hsien.

Characters and Measurements

| MALES | | | | |
|---------------------|-------|-------|-------|-------|
| A. M. N. H. Nos. | 34599 | 34602 | 34606 | 34607 |
| Dorsal Scales | 15 | 15 | 15 | 15 |
| Ventrals | 157 | 160 | 151 | 157 |
| Subcaudals | 58 | 60 | 59 | 59 |
| Upper Labials | 7-7 | 7-7 | 7-7 | 7-7 |
| Lower Labials | 8-8 | 8-8 | 9-9 | 8-8 |
| Labials enter Orbit | No | No | No | No |
| Loreal to Eye | Yes | Yes | Yes | Yes |
| Anterior Temporals | 1-2 | 2-2 | 1-2 | 2-2 |
| Posterior Temporals | 2-2 | 3-3 | 2-3 | 3-3 |
| Total Length | 236 | 296 | 468 | 216 |
| Tail/Total Length | .20 | .20 | .22 | .19 |
| FEMALES | | | | |
| A. M. N. H. Nos. | 34597 | 34598 | 34601 | 34604 |
| Dorsal Scales | 15 | 15 | 15 | 15 |
| Ventrals | 157 | 159 | 157 | 160 |
| Subcaudals | 48 | 49 | 53 | 48 |
| Upper Labials | 7-7 | 7-8 | 7-7 | 7-8 |

| FEMALES | | | | |
|---------------------|-----|-----|-----|-----|
| Lower Labials | 8-8 | 8-8 | 9-9 | 8-8 |
| Labials enter Orbit | No | No | No | No |
| Loreal to Eye | Yes | Yes | Yes | Yes |
| Anterior Temporals | 1-2 | 1-1 | 1-1 | 1-1 |
| Posterior Temporals | 3-3 | 3-3 | 3-3 | 1-2 |
| Total Length | 215 | 189 | 375 | 224 |
| Tail/Total Length | .16 | .16 | .19 | .17 |

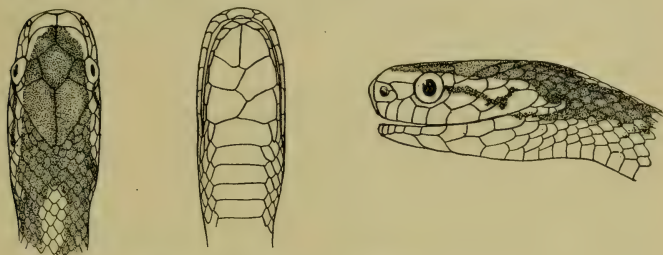


Fig. 18. *Amblycephalus stanleyi* Boulenger.

Dorsal, ventral, and lateral views of head, A. M. N. H. No. 34601, four times natural size.

From 5 to 7 rows of scales are feebly keeled and the vertebral row is never enlarged. On one side in No. 34607 a labial almost enters the orbit. The head is longer and narrower, the eye much smaller than in the other species. The top of the head is intense black conspicuously and evenly bordered with the body ground color. This alone serves to distinguish the species. All the specimens show this characteristic head pattern without variation.

An August 20 six white eggs were bought at Kuatun (No. 34610). They evidently belonged to one batch and their greater diameter ranged from 24 to 26 mm., the lesser from 12 to 13.2. On the 25th another lot containing 4 white eggs was secured. These (No. 34611) ranged from 22 to 26.2 mm. in greater, and from 14 to 15.5 mm. in lesser diameter. These eggs were said to have been dug up by men weeding the high Kuatun tea fields. There is little reason to doubt the report. Probably the snakes inhabit the scrubby, bushy, growth of the Kuatun valley. No. 34492, two well-developed but unpigmented embryos from a lot of 12 eggs, is dated August 16 and 19.

The specimens of *stanleyi* and *kuangtungensis* handled by me were docile and could not be persuaded to bite or show any other defensive tactics.

PSAMMODYNASTES

Psammodynastes pulverulentus (Boie)

A series of eighteen specimens, seven from Yenping (Nos. 33234-240), and eleven from Futsing Hsien (Nos. 33796-806), represent this species.

Stejneger (1907), on the strength of its presence in Formosa, predicted its discovery in Fukien. In 1914 Stanley reported it from this Province, and Stejneger has recently (1925) recorded a Yenping specimen. Mell (1922) says that it is common in Kwangtung. Schmidt (1927) studied seven Hainan examples.

The present series presents no problem though the ventral and caudal counts are rather low. Schmidt's Hainan series has a ventral and subcaudal range of 157-171 and 59-70; Steindachner's large Formosan lot, 161-175 and 55-70, while this range in the present series is 150-165 and 46-54.

Ten adults (Nos. 33234-239, 33797, 33799, and 33801-802) have been examined critically. All of these have upper labials 8-8, while the lower are 8-8 in all but one in which they are 7-8. The preoculars are always 1-1, the postoculars are 2-2 in six, 3-3 in two, and 2-3 in two. The anterior temporals are 2-2 in nine, and 2-3 in one; the posterior 2-2 in five, 2-3 in three, and 3-3 in two. The scale formula is regularly 17-15. The largest females of the entire series of 18 measure from snout to vent 421, 388 and 382 mm., the largest males 381, 370 and 349 mm., respectively. The eleven females are much darker than the seven males. Schmidt does not correlate sex with color even though he records six light and one dark, six males and one female, in his series of seven.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 5 | 150-159 | 154 |
| | ♀ | 5 | 153-165 | 162 |
| Caudals | ♂ | 4 | 51-54 | 52 |
| | ♀ | 5 | 46-51 | 48 |
| Tail/Total Length | ♂ | 4 | .19-.20 | .198 |
| | ♀ | 5 | .16-.18 | .168 |

Ten well-developed eggs were found in one snake. One of these measured 13×9 mm. Three eggs, one of which measured 13.5×6 mm., were found in another. Three others held 9, 8, and 5 eggs, respectively. All of these, with one possible exception, were females taken at Yenping in May. This gives an indication of the breeding time.

Two of three stomachs contained skink remains while the third held parts of a *Takydromus* species.

It is significant that *pulverulentus* was common in Futsing Hsien and about Yenping but unheard of at Kuatun.

The behavior of this snake is worthy of notice. It often holds the mouth half open when annoyed. I recall finding one lying on the edge of a mountain path. It lay as if dead for some moments while I knelt down to examine it carefully. After I had examined it closely enough to wonder why it was so still it suddenly flung itself off the path and down the hill in a most un-snakelike fashion. My Hainan field notes (Schmidt, 1927) describe interesting behavior and close observation should bring more to light.

CALLIOPHIS

Calliophis maclellandii (Reinhardt)

Three specimens, all from Ch'ungan Hsien (Nos. 33745, 34587 and 34589), represent this species. Boulenger (1899) reported a specimen from this locality (Kuatun). Stanley (1914, 1916) gives more Fukien records, while Schmidt's 1927 Hainan report includes five specimens from that Island.

Scale Characters and Measurements

| A. M. N. H. Nos. | 33745 | 34589 | 34587 |
|---------------------|-------|-------|-------|
| Sex | ♀ | ♂ | ♂ |
| Dorsal Scales | 13 | 13 | 13 |
| Ventrals | 213 | 201 | 203 |
| Subcaudals | 28 | 32 | 33 |
| Upper Labials | 7-7 | 7-7 | 7-7 |
| Lower Labials | 6-6 | 6-6 | 6-6 |
| Preoculars | 1-1 | 1-1 | 1-1 |
| Postoculars | 2-2 | 2-2 | 2-2 |
| Anterior Temporals | 1-1 | 1-1 | 1-1 |
| Posterior Temporals | 1-1 | 1-2 | 1-1 |
| Dorsal Cross-bands | 29+4 | 28+5 | 31+6 |
| Total Length | 595 | 239 | 664 |
| Tail/Total Length | .08 | .10 | .10 |

No. 33745 is much darker than the others and differs further in having more black on the belly, and a faint, broken line of spots on the mid-dorsal scale-row, each spot occupying the center of a scale. In all three specimens there are small, paired spots midway between the cross-bands, these spots being confined to the neck and posterior part of the body in No. 34587, to a short section of the middle part of the body and the region just before the vent in No. 33745, while in No. 34589 they are found everywhere except on the neck and tail. Three or four of the cross-bands are broken in Nos. 33745 and 34589.

The female contained 4 well-developed eggs. These snakes were found only in the high forests of the Kuatun region. They seem to be

stupefied and only jerk about when annoyed. I could not persuade one to strike or bite.

The ventral and caudal counts show great range of variation in this species as does the coloration. Wall has described forms differing in color alone. Schmidt's Hainan specimens are very different from the present series in color pattern and size and doubtless deserve a subspecific name. Van Denburgh's *swinhoei* from Formosa (1912) is very close to the Fukien form, but for the present and until more material is adequately reported it will have to stand. The great range of pattern in the three Ch'ungan specimens shows that large series are much safer to work with.

HEMIBUNGARUS

Hemibungarus kelloggi,¹ new species

Figure 19 .

TYPE.—A. M. N. H. No. 33744; ♀; Ch'ungan Hsien, northwest Fukien Province, China; June-July, 1925; Clifford H. Pope.

DIAGNOSIS.—A *Hemibungarus* with 15 rows of scales, no longitudinal lines on the body, and head rather distinct from the neck.

DESCRIPTION OF TYPE.—Maxillary with a pair of large, grooved poison-fangs and two small, solid teeth separated by a space from the fangs. Rostral broader than deep; frontal a little longer than deep, as long as its distance from tip of snout, and much shorter than parietals. Diameter of eye equal to its distance from edge of lip; pupil round. Upper labials 7-7, third and fourth entering eye, sixth largest. Lower labials 6-6, four pairs in contact with anterior chin-shields. Preoculars 1-1; postoculars 2-2; anterior temporals 1-2; posterior temporals 2-2. Scales in 15 rows throughout. Ventrals 203; subcaudals 28, divided. Anal divided. The total length is 774 mm., 0.09 of which is occupied by tail.

The dorsum is purplish brown with three sets of markings. The most conspicuous of these is made up of twenty-two light-edged, black cross-bands, each a scale length in width distributed down the back and descending to the edge of the ventrals. They may even join the ventral spots. This set is continued on the tail where there are three additional bands. The second set of markings is composed of a series of paired, light-edged, black spots, each about the size of a scale, located on either side of the central scale row midway between the cross-bands. On the tail these spots are a little irregular. The third set of markings is a broken series of small, black spots each occupying the center of a mid-dorsal scale. These spots are absent on the neck, tail, and the scales adjacent to the cross-bands.

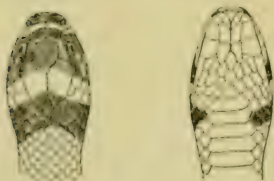


Fig. 19. *Hemibungarus kelloggi*, new species.

Dorsal and ventral views of head of type. twice natural size.

¹Named after Mr. Claude R. Kellogg, of the Fukien Christian University, who is devoting his life to the teaching of Biology in China.

The ventrum is milky white with forty-nine black blotches of varying size and outline disposed along its center. Five of the blotches fall behind the anus.

The head is black crossed by two white bands; a narrow one beginning on the second and third upper labials and crossing over the snout at the juncture of the prefrontals with the internasals; a much broader one with the form of a shallow V having its anterior edges on the posterior upper labials and its apex at the posterior tip of the frontal.

NOTES ON PARATYPES.—There are three paratypes: No. 34588 collected at the type locality, April-September, 1926; No. 33490, secured near Yenping, April-August, 1925; and No. 34104, collected in Futsing Hsien, August-October, 1925.¹

Characters of Paratypes

| A. M. N. H. Nos. | 33490 | 34104 | 34588 |
|---------------------|----------|----------|----------|
| Sex | ♀ | ♀ | ♂ |
| Dorsal Scales | 15-15-15 | 15-15-15 | 15-15-15 |
| Ventrals | 202 | 196 | 191 |
| Caudals | 33 | 34 | 38 |
| Upper Labials | 7-7 | 7-7 | 7-7 |
| Lower Labials | 6-6 | 6-6 | 6-6 |
| Preoculars | 1-1 | 1-1 | 1-1 |
| Postoculars | 2-2 | 2-2 | 2-2 |
| Anterior Temporals | 1-1 | 1-1 | 1-1 |
| Posterior Temporals | 2-2 | 2-2 | 2-2 |
| Dorsal Bands | 20+4 | 21+4 | 21+4 |
| Total Length | 542 | 201 | 193 |
| Tail/Total Length | .11 | .10 | .12 |

All of the paratypes lack the small spots on the mid-dorsal scale-row and in No. 34104 the paired spots set midway between the cross-bands are absent on the tail. In none of the paratypes do the cross-bands ever join the ventral spots and in No. 33490 they descend only to the first row of scales. They reach the ventrals in No. 34104 but just fail to do so in No. 34588. This small series exhibits great variability in details of color pattern. The resemblance of this species to *C. maccllellandii* is remarkable though the greater number of scale-rows in *kelloggi* distinguishes it at once. Also the larger of the two white head bands is V-shaped in *kelloggi* and does not completely cover the parietals nor reach the anterior temporals, while in *maccllellandii* it is broader with parallel edges, about as wide as the parietals are long, and always reaches the postoculars.

The type contained 14 well-developed eggs, while six more were found in No. 33490. These snakes were seen only in the high, forested mountains of the Kuatun neighborhood where they were anything but common. They are reputed by the mountaineers to be nocturnal and certainly

¹In the original description (Amer. Mus. Novitates, No. 320, 1928) all the paratypes were incorrectly recorded from Ch'ung'an Hsien.

their stupid behavior substantiates this reputation. In captivity they seem dazed and will only jerk about spasmodically when annoyed. I could not get them to assume any defensive posture or show any other signs of liveliness. At night the brightly marked head exhibits a strange appearance as it is moved about by the snake and tempts one to postulate on its use as an attracting device for prey. The coloration of the dorsum renders the body relatively inconspicuous. It would be interesting to know what this snake eats.

BUNGARUS

Bungarus multicinctus Blyth

Twelve specimens, seven from Futsing Hsien (Nos. 33789-95), three from Foochow (Nos. 35190-92), and two from Yenping (Nos. 33230-31), represent this species.

This snake is common on Formosa (Stejneger, 1907; Steindachner, 1914), in Kwangtung (Mell, 1922), and on Hainan where I secured seven specimens (Schmidt, 1927). Boulenger (1899) recorded it from Kuatun; Stejneger (1925) from Kuliang, near Foochow, and Foochow; Schmidt (1927) from Shaowu, which is not far from Kuatun, and Stanley (1914, 1916) from both Chekiang and Fukien Provinces.

The upper labials are 7-7 in eleven, 6-6 in No. 33790; the lower, 7-7 in all twelve; the preoculars 1-1 in twelve; postoculars 2-2 in twelve; anterior temporals 1-1 in ten, 1-2 in one, and undetermined in one; posterior, 2-2 in eleven, undetermined in one. The scales are uniformly in 15 rows.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 5 | 206-211 | 208 |
| | ♀ | 7 | 200-211 | 207 |
| Caudals | ♂ | 5 | 45-51 | 47 |
| | ♀ | 7 | 41-48 | 44 |
| Tail/Total Length | ♂ | 4 | .12-.12 | .12 |
| | ♀ | 7 | .11-.13 | .12 |
| Body Bands | ♂ | 5 | 43-45 | 44 |
| | ♀ | 7 | 35-44 | 40 |
| Tail Bands | ♂ | 5 | 11-16 | 14 |
| | ♀ | 7 | 9-12 | 11 |

Boulenger's Kuatun specimen was probably caught in some neighboring valley and brought into the high mountains by a traveler.

Bungarus wanghaotingi,¹ new species

TYPE.—A. M. N. H. No. 35230; ♀; Yuan Kiang, southwestern Yunnan Province, China; November, 1926; Walter Granger.

DIAGNOSIS.—Allied to *candidus* from which it differs chiefly in having a higher ventral count. The dorsal bands are much more numerous than in *multicinctus*.

DESCRIPTION OF TYPE.—Rostral much broader than high, touching six scales, its suture with first upper labial about one-fifth as long as that with nasal; internasals two-thirds as long as prefrontals, which in turn are three-fourths as long as frontal; frontal slightly shorter than its distance from tip of snout, just as wide as parietals, which are as long as their distance from rostral; a single scale between nasal and eye; 7 upper labials, third and fourth entering orbit; 2 postoculars, upper twice as large as lower; one temporal; 7 lower labials, first four in contact with anterior chin-shields, fourth much the largest; posterior pair of chin-shields shorter than anterior. Scales in 15 rows throughout; ventrals 228; subcaudals 53; total length 484 mm., 0.13 occupied by tail; anal and subcaudals entire.

The black ground color is crossed by 23 white bands on the body, 11 on the tail. These white bands cover 3 mid-dorsal scales on the neck where they are sixteen scale-lengths apart, while posteriorly they are only half as wide, and four scale-lengths apart. All of them expand before joining the uniform white of the belly, and near the center of each, at its junction with the belly, there is a small, dark spot. Many of the white bands have a few black-centered scales. The black of the ground color barely encroaches on the tip of the ventrals. Above the upper labials the top and sides of the head are black. On either side of the neck, just back of the parietals, the scales are dimly white-tipped.

The single paratype (No. 35229), also a female, comes from the type locality, and closely agrees with the type in coloration, the dorsal bands being 22+10. The ventrals are 225, the subcaudals 47, and the tail occupies 0.11 of the total length, 428 mm. The head is imperfect, so some of the characters cannot be made out.

Wall (1924) gives the ventral range of *candidus* as 195–218, and presumably he has examined scores of specimens, so the average would hardly exceed 210, while the average of the present species would be as high as 225 in all probability. The subcaudal range in *candidus* is 37–50, so again there is a marked difference though in this character not so great a one. The number of cross-bands on the body are the same in the two species, but the number on the tail in both examples of the new species exceeds the upper limit for *candidus*. The species are, however, closely related.

The range in number of body cross-bands for *multicinctus* from southeastern China is 35–50 among twenty-three specimens from Hainan, Formosa, and Fukien, while in no one of the twenty-three are there more than 216 ventrals. Wall gives the range in ventrals for this species as 194–221, but the foregoing figures definitely show that the southeastern Chinese specimens are widely separated from the new Yunnan form in ventral count as well as number of cross-bands.

NAJA**Naja hannah** (Cantor)

A single specimen of the king cobra (No. 29944) was secured by Mr.

¹Named for Mr. Wang Hao-t'ing of Peking, who for two years faithfully painted reptiles and amphibians from life for the Third Asiatic Expedition.

Claude R. Kellogg near Foochow and presented to the American Museum. I know of no previous record of its occurrence so far north in eastern China. It is presumably rare in Fukien, for I was unable to secure one myself nor did I hear tales of its presence. Schmidt (1927) mentions a skin that I saw in Hainan which may be taken as evidence of its occurrence there; Mell (1922) reports it from Kwangtung where it seems to be abundant enough.

The specimen at hand has on either side 7 upper labials and 8 lower, 4 of the lower in contact with the anterior chin-shields; 1 pre- and 3 postoculars; 2 anterior and 2 posterior temporals; 15 scale-rows before the anus and at midbody, 19 across the neck; 243 ventrals and 90 subcaudals, all but 9 of which are in 2 rows. It, then, agrees well with recorded series. The badly stretched skin is 2100 mm. long to the tail which measures 460 mm. The forward and middle parts of the body are dark brown crossed by wavy black bands a little more than a scale-length in width and three to four scales apart. Posteriorly this banded pattern gradually merges into that found on the tail which has 15 white crossbands on a dark ground-color. Each band is as wide as the length of a scale. Ventrally the body is dark, the tail black.

***Naja naja atra* (Cantor)**

Fourteen cobras were secured, nine from Futsing Hsien (Nos. 33780-88), two from Yenping (Nos. 33232-33), one from Ch'ungan Hsien (No. 33616), and two from Hok'cu (Nos. 35051-52).

Schmidt's 1927 report included one from Yenping, one from Futsing Hsien, and thirteen from Hainan. Stanley (1914) has reported numerous specimens from Kuatun and Ningteh in Fukien.

The counts and measurements of the present series fall within reported limits. The upper labials are 7-7 in all fourteen; the lower 10-10 in five, 9-9 in four, 9-10 in two, and 8-9, 8-8, and 10-11 in one each. The preoculars are uniformly 1-1; the postoculars, 3-3 in five, 2-3 in four, 1-2 in three, and 2-2 in two. The anterior temporals are 2-2 in ten, 1-1 in three, and 1-? in a damaged specimen; the posterior, 3-3, 3-4 and 2-3 in three each, 4-4 and 2-2 in two each. They cannot be made out in the remaining one. The scale formula is 25-21-15 in eleven, 23-21-15 in one. The three largest females among eight measure from snout to vent 1135, 1045 and 925 mm., the two largest males among four, 960 and 950 mm., respectively.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|-----------|----------|
| Ventrals | ♂ | 4 | 164-170 | 168 |
| | ♀ | 10 | 167-178 | 173 |
| Caudals | ♂ | 2 | 50-50 | |
| | ♀ | 6 | 43-45 | 44 |
| Tail/Total Length | ♂ | 2 | .145-.150 | .147 |
| | ♀ | 4 | .13-.14 | .138 |

In color pattern there is great variation. The ventrum is always creamy white to a point just posterior to the spot on the "hood." This white is followed by a dark band covering some four scales and behind this comes a second light area varying greatly in extent. This last light area may even extend to the vent and beyond or it may be only a few scales wide followed by a uniformly dark section extending even to the end of the tail. Combinations of these extreme patterns are frequent and take the form of dark and light banded bellies in which the dark predominates posteriorly, or bellies light in the center and dark along the sides. Among fourteen specimens there are two with light bellies, two more with the bellies light down the center, while more than half the ventrum is uniformly dark. The dorsal cross-bands, usually light, may be narrow and single, narrow and paired, wider and black-edged, or even dark, bordered with light. They are often absent anteriorly and rarely almost absent posteriorly. My series are not large enough to show locality and altitude differences.

This cobra is certainly common about Yenping and in Futsing Hsien. It is interesting to find two loaches (*Misgurnus anguillicaudatus*) and an eel (*Fluta alba*) in the stomach of a Hok'ou specimen. This shows an adaptation to food because of its prevalence and accessibility for Hok'ou is in the rice-culture region where loaches and eels abound in flooded and barely flooded fields. In the latter the cobra probably finds the capture of common field-fish very easy. A Futsing specimen contained two rodents, probably house-rats. Nine well-developed eggs were found in the Hok'ou female. One of the larger is 60 mm. long. This snake was killed between June 28 and July 12, so we have an indication of the date of its breeding. It is significant that none of the three adults from Futsing bears eggs. All were taken after the 25th of August.

HYDROPHIS***Hydrophis cyanocinctus* Daudin**

Three specimens from the region of Foochow (Nos. 35201-203) represent this species.

Malcolm Smith (1926) gives Shanghai and Foochow records and says that these snakes are abundant in the Straits of Hainan, while Stejneger (1907) reports them common about Formosa.

The characters are as follows:

| A. M. N. H. Nos. | 35201 | 35202 | 25203 |
|------------------|----------|----------|----------|
| Sex | ♂ | ? | ♂ |
| Dorsal Scales | 27-37-32 | 27-37-29 | 27-41-35 |
| Ventrals | 337 | ? | 326 |
| Upper Labials | 8-8 | 7-7 | ? |
| Lower Labials | 9-9 | 8-9 | ? |
| Preoculars | 1-1 | 1-0 | 1-1 |
| Postoculars | 2-2 | 1-1 | 2-2 |
| Temporals | 2-2 | 2-2 | 2-2 |

The first figure in the scale formula gives the number of rows at a point one head-length behind the head; the second, the maximum number on the body, while the third refers to the number at a point one head-length before the anus. The nasals are in contact in all three specimens.

The annuli are distinct on the back and belly but narrow and faint on the lower sides in Nos. 35201 and 35202. In No. 35203 they are distinct on the back but only slightly narrowed on the lower sides, while along the belly they tend to run together to form an indistinct, ventral stripe.

Crotalidæ

AGKISTRODON

Agkistrodon acutus (Günther)

Plate XVIII, Figure 1

Thirty-six specimens, all from Ch'ungan Hsien (Nos. 33606-615 and 34244-269) represent this species described in 1888 from the "Mountains north of Kiukiang" by Günther (see Plate XVIII, fig. 1).

Boulenger (1899) lists two examples from Kuatun; Schmidt (1927) records one from Hunan.

Sixteen specimens (Nos. 33607-610, 33613, 33615, 34247, 34252, 34259-260, 34262, and 34265-269) have been examined and found to agree with those formerly described. The upper labials are 7-7 in all but two in which they are 6-7; the lower, 11-11 in fourteen, and 10-11 in two. The scale formula is 23-21-17 in thirteen, and 23-23-19 in three. Two rows usually drop out on the neck so a slight shifting of position in counting will give the formula 21-21-17 in most specimens. The anal is entire in all. Nearly all of the subcaudals are divided, the number of entire ones ranging from 5 to 16 and averaging 7.4.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGE |
|-------------------|-----|---------------------|----------|---------|
| Ventrals | ♂ | 8 | 157-165 | 160 |
| | ♀ | 8 | 165-171 | 168 |
| Caudals | ♂ | 8 | 53-60 | 57 |
| | ♀ | 8 | 52-55 | 53 |
| Tail/Total Length | ♂ | 6 | .14-.15 | .145 |
| | ♀ | 5 | .12-.14 | .130 |

Nearly all of the adult specimens were skinned. A large male in the flesh measured from snout to vent 1120 mm., a large female 1100. The measurements of the skins are inaccurate but indicate that the females attain a greater size. The largest skin, that of a female, measures from snout to vent 1450 mm.

Although the pattern remains generally the same, the complete change in intensity and comparative value of the varied shades of brown, gray, and black cause the adult to look very different from the young. The adults are darker but this darkening takes place to a greater degree in definite areas. The top of the head is light gray in the young, so the dark streak posterior to the eye is brought out in strong outline. Its lower edge, moreover, has a narrow light border. In the largest examples the top and upper side of the head is uniformly very dark, the streak from the eye having lost its light border and united with the darkened top of the head. The lateral triangles in the young are also narrowly light-bordered, but this border is lost in the general darkening brought on by age. Thus, the lighter young are more vividly marked than the darker adults.

One female contained 26 well-developed eggs. The remains of a bird were found in the stomach of one specimen, and a large mountain rat was disgorged by another. A half-grown *acutus* was found in the belly of an *E. carinata*.

I caught no less than five of these snakes myself. Three of the five were taken on a wild, boulder-strewn, forested mountain side. Another was captured in a deep, forested, rocky ravine. Three of the five, then, were discovered among boulders while only one was not found in such a locality. *A. acutus* is sluggish, reluctant to either fight or retreat, but it will do either with vigor when aroused. I have seen it handled by the Chinese though the few I caught did not hesitate to bite viciously when pinned. About San Chiang it is abundant in the valleys and on the hill-sides where cliffs and boulders abound. Its habits and juvenile pattern strongly suggest the copperhead of the United States, while the

ontogenetic color change brings the New World water moccasin to mind. These three snakes belong to the same genus.

Stories of its attacking man are of course false (Wall, 1903 quoting Heude), and I failed to detect any noise produced by its tail (Günther, 1888). The well-developed snout of course projects upward and forward, not straight forward as figured by Günther in the original description.

TRIMERESURUS

Trimeresurus monticola Günther

Plate XVIII, Figure 2

Fourteen specimens (Nos. 34270-276, and 34288-294), and two lots of embryonic material (Nos. 34295, and 34612), all from Ch'ungan Hsien, represent this species.

Stanley (1914) records *monticola* from Chekiang and Fukien Provinces.

Schmidt (1927) described *orientalis* from Shaowu, a locality also in northwest Fukien. I have examined his type and find that it and the Ch'ungan specimens are identical. *T. orientalis* is "distinguished from its very near relative, the Himalayan *T. monticola*, by having ten upper labials instead of eight or nine," according to the description. In the present series the upper labials are 9-9, and 9-10 in five examples each, 10-10 in two, 10-11 and 9-11 in one each. Werner (1926) records Kwangtung and Yunnan material that links *monticola* with *orientalis*, and, in his opinion, makes them inseparable. He had two specimens with but 8 upper labials. In the light of the most recent data, *orientalis* cannot well stand. However, the great uniformity of the Fukien specimens in scale counts and coloration indicates that a Chinese subspecies, for which Schmidt's name *orientalis* is available, may ultimately be recognizable. Unfortunately, I have no Himalayan specimens for comparison. It is also possible that the Kiating specimens recorded by Boulenger represent a third subspecies.

The characters for the present series, half of which are newly hatched specimens from one batch of eggs, follow:

The upper labials are 10-10 in six, 11-11 in four, 11-12 in two, 10-11 and 12-12 in one each; the postoculars are 2-2 in eleven, 2-3 in two and 3-3 in one; the suboculars are 2-2 in twelve, 3-3 and 1-1 in one each. There are 7 scales between the supraoculars in six, 8 in six, and 6 in two specimens. The scales are uniformly in 19 rows just before the anus; 23 at midbody in all but two with 25, and from 23 to 28 on the neck with 25 in seven, 26 in three, 27 in two, 28 and 23 in one each. It is doubtful if all the variation on the neck is actual, for much of it is probably due to a

slight difference in the point of count. The only adult specimens, six females, are remarkably uniform in size, measuring from snout to vent 535, 530, 525, 520, and 503 mm., respectively. Their coloration exhibits very little variation. The following table shows that the same is true of their ventral and caudal counts:

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|-----------|----------|
| Ventrals | ♂ | 3 | 137-138 | 137.3 |
| | ♀ | 11 | 137-144 | 140.9 |
| Caudals | ♂ | 3 | 41-43 | 41.6 |
| | ♀ | 11 | 36-38 | 36.8 |
| Tail/Total Length | ♂ | 2 | .163-.166 | .164 |
| | ♀ | 10 | .12-.14 | .135 |

In order to show the range of variation within one family I shall now give separately the data for the seven juveniles hatched from one batch of eggs. These seven specimens are, however, included in the preceeding summary. The upper labials are 9-10 in four, 9-9 in three; the lower, 10-10 in six, 11-12 in one; the postoculars 2-2 in five, 2-3 in two; the suboculars 2-2 in all. Before the anus are the usual 19 rows of scales, and at midbody the usual 23 except in one which has 25; on the neck there are 26 in three, 25 in two, 27 and 28 in one each.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|-----------|----------|
| Ventrals | ♂ | 3 | 137-138 | 137.3 |
| | ♀ | 4 | 139-142 | 141.5 |
| Caudals | ♂ | 3 | 41-43 | 41.6 |
| | ♀ | 4 | 36-38 | 36.9 |
| Tail/Total Length | ♂ | 2 | .166-.163 | .164 |
| | ♀ | 3 | .146 | .146 |

Two of the seven were dissected from the eggs and it is interesting to note that with them, one male and the other female, there is a reversal of proportional tail-length in the sexes, the male having a tail only .143 of the total length, while in the female it is .152. In the juveniles it has decreased to .146 in the female, but increased to .164 in the young males. The adult females show a greater decrease, averaging only .135. Unfortunately, no adult males are at hand. The only half-grown female has a very short tail (.125) so the reversal in proportion may be more apparent than real.

I was told about this viper by the Kuatun Chinese for three months before being able to secure any. This is probably because these snakes

are so secretive that only the nesting females can be found. All of my large examples are females so the whereabouts of the males remains somewhat of a mystery.

The Kuatun people prepare from bamboo a coarse fibre from which paper is made. This necessitates the shredding of great quantities of bamboo, and waste material from this process lies all about in low piles. It was in one of these that a beautiful *monticola* nest was found August 12, at Upper Kuatun. The snake did not desert the nest and on the 16th I photographed it (Plate XVIII, fig. 1). The female remained on guard until the eggs had actually been removed. They were deposited in a roughly rounded cavity some twelve inches below the surface of the very low pile of decaying, fibry waste. The eggs, six in number, were white and adherent in a globular mass. Four were measured and found to range from 26 to 40 mm. in greater diameter, and from 23 to 24 in the lesser. One contained a barely pigmented embryo 128 mm. long.

Again on the 16th, and not far away, I was shown another nest freshly dug up in a grassy, open tea field. The adult guarded the eggs but the nest had been so deranged that its form or depth could not be made out, though obviously it had been within a few inches of the surface. The eggs were white, adherent and slightly longer than those from the first nest, the largest being 42 mm. long. One embryo was faintly pigmented and 140 mm. long.

A batch of five *monticola* eggs that had been roughly handled, was brought in on the 12th of August. They were like those already described.

Several eggs from the above batches were kept but all the young emerged by September 12. One newly hatched specimen measures 183 mm. from snout to end of tail.

These vipers strike from an S-shaped, or single coil. They are sluggish but the females when guarding their eggs strike viciously.

A small shrew was found in the stomach of one adult.

***Trimeresurus mucrosquamatus* (Cantor)**

Fourteen specimens, ten of which are from Yenping (Nos. 33209-218) and four from Futsing Hsien (Nos. 33763-66), represent this species. Schmidt's 1927 report includes one specimen from Yenping, and Stanley (1914) has also reported this species from Fukien.

Long known to be common on Formosa, it may now be considered abundant in parts of Fukien and in northern Kwangtung (Mell, 1922).

The present series conforms well with those previously reported as

the following summary will show. The upper labials are 10-10 in five, 9-10 in three, 9-9 in two, 8-9, 8-10, 10-11, and 11-11 in one each; the lower labials 14-15 in five, 15-15 in four, 14-14 in two, 15-16, 14-16, and 13-14 in one each. The subocular is regularly single; the preoculars are 3-3 in nine, 2-2 in three, 2-3 in one, and 3-4 in one; the postoculars are 2-2 in nine, 2-3 in three, 3-3 in one, and 3-4 in one. The scales between the internasals are 4 in nine, and 3 in five, while eight specimens have 14 scales between the supraoculars, three have 15, two have 16, and one has only 12. There are 3 rows of scales between the subocular and the supra-labials in all but three specimens which have only 2. All have 19 rows of scales just before the vent, while all but five have 25 around the neck. At midbody there are usually 25.

The four largest females measure 970, 858, 797, 728 mm. from snout to vent, while the same measurements for the largest males are 723, 627, 610, and 605 mm., respectively. Sexual dimorphism in size is marked.

Summary of Counts and Measurements

| | SEX | NO. OF SPECIMENS | EXTREMES | AVERAGES |
|-------------------|-----|---------------------|----------|----------|
| Ventrals | ♂ | 7 | 201-218 | 210 |
| | ♀ | 7 | 205-214 | 211 |
| Caudals | ♂ | 7 | 82-91 | 89 |
| | ♀ | 4 | 78-88 | 82 |
| Tail/Total Length | ♂ | 7 | .17-.19 | .184 |
| | ♀ | 4 | .16-.17 | .165 |

The distribution of this species in Fukien is interesting. It was common in the low mountains near the coast of Futsing Hsien, while in the higher ones about Yenping it was abundant. In the still higher Ch'ungan range we could find no trace of it and yet it has been reported from Horisha, Formosa (Oshima, 1910), which, according to maps, is situated in the central region at considerable altitude, and Barbour (1909) records it from "Bankoro, in the highlands of central Formosa." More material is much needed.

During a noon-hour stay in a mountain village near Yenping two of these snakes were discovered, one lying on top of the wall and just below the roof of a work house, and the other in a crevice of a rock wall nearby. The former was reposing in sight of many laborers, where it appeared to be perfectly at home, and was easily taken. The villagers said that these vipers are frequently found in the rockwork. On two occasions a rat was taken from the belly of one of these snakes, and I recall seeing one disgorge a bird. They are sluggish and reluctant to strike.

Three females contained, respectively 5, 9, and 13 well-developed eggs.

There is remarkable agreement between Formosan and mainland specimens. Oshima (1910) and Steindachner (1914) give counts of ten and seven examples, respectively, which, when taken together, show a ventral and subcaudal range of 202-219 and 64-95. The range in the present series is 201-218 and 78-91. The ventral agreement is remarkable, and the subcaudal not much less so for among the seventeen only two counts fall below 76, and it is probable that one or more low counts are due to incomplete tails.

***Trimeresurus gramineus gramineus* (Shaw)**

Eight specimens represent this species, six from Futsing Hsien (Nos. 33767-768, 33770-772, and 33774), one from Yenping (No. 35145), and one from Ch'ungan City (No. 34286). Schmidt's 1927 report included forty-three from Hainan Island, and one bought in Anhwei Province.

This is the plain and plateau form. In the low mountains along the coast it was found associated with *stejnegeri*, and on the Ch'ungan Hsien plateau it ranges to an altitude of about 1200 feet.

The nine characters which serve to distinguish it from *stejnegeri* have been given in detail under that species and need not be repeated. The following are of no diagnostic value but may be recorded briefly. Five examples have suboculars 1-1, two have them 2-1, while only one has 2 on each side. The preoculars are 2-2 in five, and 3-3 in three specimens, while the postoculars are 2-2 in three, 2-3 in three, 2-1 in one, and 3-3 in one. There are 10 scales between the supraoculars in three, 11 in two, 12 in two, and 13 in one. The scale-rows are invariably 21-21-15. The largest females measure 666 and 614 mm. from snout to vent. The only male of any size is but 409 mm. to the vent. Unfortunately, the series of *gramineus* is too small to enable one to compare it in size with *stejnegeri*. The upper half of each scale of the first row is almost invariably white, while the lower is green or red. The lateroventral stripe thus formed is not only variable in color but in intensity as well. The amount and shade of the red on the tip of the tail varies considerably.

A rat was found in the belly of one from Futsing, while the Ch'ungan City specimen contained 4 well-developed eggs.

***Trimeresurus gramineus stejnegeri* (Schmidt)**

Forty-six specimens represent this species, seven from Futsing Hsien (Nos. 33769, 33773, and 33775-779), eleven from Yenping (Nos. 33219-

229), and twenty-eight from Ch'ungan Hsien (Nos. 33588-605, 34277-285 and 34287). *T. stejnegeri* was described by Schmidt in 1925 from one Anhwei and two Fukien snakes.

If the first student of these pit-vipers had had the present series of fifty-four specimens to work with no confusion could possibly have arisen because two perfectly distinct species are represented, the first a plain and plateau, the second a mountain and forest form.

Most attempts to classify these snakes have been based on such inadequate material that the results have been almost worthless. The first good effort that helped to straighten the matter out was made by Mell (1922) who observed these snakes in Kwangtung and concluded that there was a northern mountain and a southern lowland form. Schmidt (1927) next found that specimens from the lowlands of Hainan agreed with Mell's southern form, but two from the mountains of Fukien, and one of uncertain origin, he named *stejnegeri*, regarding the new form as identical with Mell's northern, mountain form. *T. stejnegeri* is based on four characters as follows: (1) "very small shields between the chin-shields and the first ventral plate, (2) the smaller and more widely separated supranasals, (3) the distinct first labial . . . , (4) and the usual uniform green coloration of the side of the head."

Stejneger (1927) has recently discussed the whole matter in great detail and concluded that two forms occur in southeastern China which he calls *Trimeresurus gramineus gramineus* and *Trimeresurus gramineus stejnegeri*. In separating them he uses Schmidt's first three characters, omits his fourth, and adds the "presence or absence of one or more scales between the nasal and the shield bordering the pit anteriorly." Thus, he has greatly simplified the matter and conclusively reduced the green pit-vipers of southeastern China to two forms, a southern (lowland) and a northern (mountain) form.

The series at hand essentially substantiates Stejneger's conclusion though it is hard to see why two snakes differing in nine characters should be treated trinomially. I find little sign of intergradation and in habits they are distinct as is shown by their choice of habitat. It is not merely a question of altitude, for the *stejnegeri* taken on the Ch'ungan Hsien plateau was living at a much higher altitude than those taken in the low, coastal mountains of Futsing Hsien. As much might be said about the question of latitude, at least until the range of *stejnegeri* is better known. The habitat preference is clearly demonstrated by Mell's as well as the present series.

The two species as represented in the present series differ in nine characters as follows:

(1) INTERNASALS SEPARATE OR IN CONTACT.—The internasals are separated in all of the forty-six *stejnegeri* while they are in contact in seven out of eight *gramineus*. In the eighth they are barely separated.

(2) FIRST UPPER LABIAL DISTINCT OR FUSED WITH NASAL.—Here again the character proves to be good, for labial and nasal are separate in all of the forty-six *stejnegeri* and fused in all of the eight *gramineus*. However, there is a notch in the posterior edge of the scale formed by this fusion in most of the *gramineus*.

(3) GULFERS PAIRED OR IRREGULAR.—There is no real exception to the rule of paired gulfers in *gramineus* and irregular ones in *stejnegeri* in the present series, even though in four of the latter they approach regularity of arrangement.

(4) PRESENCE OR ABSENCE OF ONE OR MORE SCALES BETWEEN THE NASAL AND THE SHIELD BORDERING THE PIT ANTERIORLY.—There are no signs of such scales in six *gramineus* while the remaining two have a very minute one on one side only. All but three of the forty-six *stejnegeri* have one or more such scales on each side. These scales are 1-1 in twenty, 2-2 in seventeen, 2-1 in five, and 2-3 in one.

(5) COLOR OF THE BELLY.—This, though only a color character, is after all the simplest as well as the surest, for all of the *stejnegeri* have the green belly, while *gramineus* (with one doubtful exception, No. 35145, which will be discussed below) has white abdominal plates. The belly color is always uniform.

(6) COLORATION OF THE SIDE OF THE HEAD.—In *gramineus* the upper half as far down as the lower edge of the eye is green, the lower white. Any sign of a stripe is lacking in all but No. 35145 in which there is an indication of one under the eye. The side of the head is uniform green in *stejnegeri*, but this is often encroached upon by a forward extension of the lateroventral stripe. Usually this stripe reaches the eye in the male but seldom does so in the female. The following table gives the data on this point:

| | ♂ | ♀ |
|------------------------|----|----|
| Stripe to Eye | 17 | 4 |
| Stripe to Angle of Jaw | 6 | 1 |
| Stripe Absent on Head | 5 | 13 |

(7) LABIAL COUNTS.—This may best be shown by the following table, since there is considerable overlapping and irregularity.

| Labial Formula | UPPER | | LOWER | |
|----------------|--|---|--|---|
| | <i>stejnegeri</i> No. of Specimens | <i>gramineus</i> No. of Specimens | <i>stejnegeri</i> No. of Specimens | <i>gramineus</i> No. of Specimens |
| 9-9 | 4 | | | |
| 9-10 | 5 | | | |
| 10-10 | 4 | 2 | | |
| 10-11 | 3 | 3 | | |
| 11-11 | | 2 | 1 | |
| 11-12 | | 1 | 4 | |
| 12-12 | | | 4 | |
| 12-13 | | | 3 | 3 |
| 11-13 | | | 2 | |
| 13-13 | | | 2 | 1 |
| 13-14 | | | | 1 |
| 14-14 | | | | 3 |

(8) NUMBER OF VENTRAL AND SUBCAUDAL PLATES.—*T. g. stejnegeri* has an average of 166 ventral plates and a range of 161–170, while the same figures for *gramineus* are 158 and 153–162. Counts were made on sixteen examples of the former and eight of the latter. The subcaudal plates in sixteen *stejnegeri* range from 60 to 71 and average 66 while in *gramineus* they range from 51–66 and average 55. The two male *gramineus* have 62 and 66 plates while the six females have from 51 to 54 only. There seems to be a sexual difference but this point cannot be determined with such a small series.

(9) PROPORTIONATE TAIL-LENGTH.—The difference between the tails of the two sexes of *gramineus* indicated under character eight is substantiated by the measurements given in the following table. The figures in the column represent the number of specimens having a certain proportionate tail-length.

| Percentage of Length Occupied by Tail | <i>gramineus</i> | | <i>stejnegeri</i> | |
|---|------------------|---|-------------------|---|
| | ♂ | ♀ | ♂ | ♀ |
| 0.13 | | 2 | | |
| 0.14 | | 2 | | |
| 0.15 | | 2 | | |
| 0.16 | | | | |
| 0.17 | | | | 1 |
| 0.18 | 1 | | 1 | 3 |
| 0.19 | | | | 5 |
| 0.20 | 1 | | 1 | |

No. 35145 is brown instead of blue (in alcohol) and the belly is not pure white. I account for this through poor preservation for probably my collector purchased it from a farmer who had put it temporarily in native spirits. This is also probably the case with Schmidt's Anhwei specimen, No. 23534, for it was bought at Wuhu (Schmidt, 1927, p. 546).

A few characters which do not help to separate these particular species remain to be recorded. The suboculars are 1–1 in nine out of ten, and 2–1 in the tenth example; the postoculars are 2–3 in four, 2–2 in two, 3–3 in two, 2–4 in one, and 3–4 in one, while the preoculars are 3–3 in seven, 2–2 in two, and 2–3 in one. There are 12 scales between the supraoculars in eleven, 11 in three, and 13 in two. The scale-rows are 21–21–15 in eleven, and 23–21–15 in five. From snout to vent the four largest females measure 731, 725, 625 and 575 mm., while the four largest males measure 682, 670, 653, and 611, respectively. The upper half of each scale of the first row is almost invariably white, while the lower is usually green or red, the former color predominating in the females and the latter in the males. The lateroventral stripe thus formed is not only variable in color but in intensity as well. The amount and shade of the red on the tip of the tail varies considerably.

These snakes may be found in abundance at night in the cascading streams of the high mountains about Kuatun. On three occasions I

found them prowling among the boulders lying in stream beds. One night two were seen. This is especially significant because in all my hunting in China I never found one anywhere else. A reliable collector reported killing four one night. They probably go to the streams in search of frogs. One of those I found had just eaten a species of *Rana*, and another speedily swallowed a small *Megalophrys* that I gave it. The stomachs of four of the preserved series contain frog, 1 rat, and 1 shrew remains.

When surprised at night this snake not only strikes viciously but often violently thrashes the entire posterior end of its body about in a most surprising fashion. A Chinese used to bring these snakes to me, carrying them in his bare hands. I watched him more than once and can only conclude that, like certain other snakes, these vipers do not always bite objects actually attached to them but rather strike anything waved in front of them. This same man insisted that these snakes would remain hanging from a peg "overnight." We experimented and found that they will remain thus suspended for minutes at a time apparently reluctant to drop to the ground. This is an indication of arboreal habits.

One female contained 4 well-developed eggs.

The additional characters cited in the present series, together with the fact that both forms occur in Futsing without indication of intergradation, lead one to suppose that the two are distinct species rather than subspecies, as Stejneger has suggested. The subspecific status may be maintained until the related forms can be more fully examined.

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PLATES XVII TO XX

PLATE XVII

Fig. 1. *Ophisaurus harti* and eggs.

This specimen was photographed on its nest, August 28, before it had taken alarm.

Fig. 2. Adult *Ophisaurus harti* Boulenger.



PLATE XVIII

Fig. 1. *Agkistrodon acutus* (Günther).

This photograph was taken on August 16, four days after the discovery of the viper and eggs, for the snake continued to guard its nest until the eggs were removed.

Fig. 2. *Trimeresurus monticola* and eggs.



PLATE XIX

Fig. 1. San Chiang, Ch'ungan Hsien, Fukien.

Work in the Ch'ungan Hsien region was carried on with this village as a base. The base of Kuatun Mountain shows dimly in the distance. Bamboo groves are also seen in the background. *Natix percarinata* abounded in the foreground rice fields, the highest rice cultivation of the region.

Fig. 2. The high range of mountains opposite Kuatun Mountain seen from Lower Kuatun.

All of the highest tops of the mountains of this region are "bald." The heavy forests of the steep slopes are shown here. In the foreground is a bark roof.



PLATE XX

Fig. 1. Ling Shih Monastery, our Futsing Hsien base.

This Monastery stands in a forested, mountain-encircled basin with a rim 3000 feet high at some points.

Fig. 2. View across a Futsing Hsien plain.

Most of the mountains of this Hsien have been denuded of their forests as those seen in the background of this photograph. Highly cultivated plains nearly at sea-level separate low mountain ranges.



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ADDITIONS TO THE FAUNA OF THE GASHATO FORMATION OF MONGOLIA¹

By W. D. MATTHEW, WALTER GRANGER, and GEORGE GAYLORD SIMPSON

In 1923 a small collection of fossil mammals was made from the Gashato Formation, which unconformably overlies the Djadokhta Formation near Shabarahk Usu in the Gurbun Saikhan Basin, north of the eastern end of the Altai Mountains. This collection was described in 1925.² In that year a second, larger collection was made from these beds, including the remains of five new genera and six new species. The multituberculates have already been discussed,³ and preliminary descriptions of the remaining new forms are given in the present paper. A revised faunal list follows:

MULTITUBERCULATA

Teniolabididae

Prionessus lucifer Matthew and Granger, 1925

Sphenopsalis nobilis Matthew, Granger, and Simpson, 1928

?INSECTIVORA

?Leptictidae

Praolestes nanus, new genus and species

Inc. sed.

Pseudictops lophiodon, new genus and species

?GLIRES

Eurymylidae, new family

Eurymylus laticeps Matthew and Granger, 1925

CREODONTA

?Oxycænidae

Hyracolestes ermineus Matthew and Granger, 1925

?Hyænodontidae

Opisthopsalis vetus, new genus and species

Inc. Sed.

Sarcodon pygmaeus Matthew and Granger, 1925

?CONDYLARTHRA

Inc. sed.

Phenacolophus fallax Matthew and Granger, 1925

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 93

²Matthew, W. D., and Granger, W. Amer. Mus. Novitates, No. 189.

³Matthew, W. D., Granger, W., and Simpson, G. G. 1928, Amer. Mus. Novitates, No. 331.

AMBLYPODA

Uintatheriidae

Prodinoceras martyr, new genus and species

NOTOUNGULATA

Arctostylopidae

Palaeostylops iturus Matthew and Granger, 1925

Palaeostylops macrodon, new species

On the basis of the first collection, Matthew and Granger (1925, pp. 1-2) concluded that "the presence of a multituberculate suggests Paleocene or late Cretaceous age; the ancestral relationship of *Palaeostylops* to the Wasatch genus *Arctostylops* is indicative of Paleocene, Torrejon or possibly older age. The remaining genera throw no light upon the correlation . . . but they are not incongruous with a Paleocene fauna, although not representing the ancestral relationship to the Eocene faunæ of Europe and America that had been anticipated."

Most of the mammals of the Gashato appear to represent phyla previously unknown. From the standpoint of European and American early Tertiary mammals they are aberrant, and, despite their early age and primitive stamp, they are for the most part too specialized and peculiar to cast much light either on phylogeny or on correlation.

Including multituberculates, creodonts, and ungulates of archaic character, the fauna is, however, definitely of Paleocene type. As previously noted, *Palaeostylops* is clearly allied to the Wasatch *Arctostylops* and is slightly less advanced than the latter. To this is now added the still more definite evidence of *Prodinoceras*, which is closely related to an undescribed genus from the Clark Fork, uppermost Paleocene, of Wyoming. *Prodinoceras* may be a little more advanced than the Clark Fork genus, but this would not necessarily militate against their essential contemporaneity, especially if, as seems probable, Mongolia was closer than Wyoming to the center of origin of the uintatheres. Rodents do not occur in the American or European Paleocene, but *Eurymylus*, even if it prove to be a true rodent, is not nearly related to any other known genus and the earlier presence of the Order in Mongolia would not be anomalous.

More exact correlation of so peculiar an assemblage cannot now be definitively made, but the rather specialized nature of its members and the relationship of *Prodinoceras* to the Clark Fork genus suggest that it belongs in the later Paleocene.

The known Paleocene mammal horizons of the world may be tentatively correlated as follows:

| | North America | | | | Europe | Asia |
|--------|---------------|------------|------------|----------|------------|---------|
| Upper | Tiffany | Clark Fork | Fort Union | Paskapoo | Cernaysian | Gashato |
| Middle | Torrejon | | | | | |
| Lower | Puerco | | | | | |

The drawings in this paper are by John Germann.

Praolestes nanus, new genus and species

TYPE.—Amer. Mus. No. 21718, part of left lower jaw with last premolar and first two molars.

CHARACTERS.—Last premolar moderately compressed, with sharp, recurved main cusp, distinct anterointernal accessory cusp, very inconspicuous cuspule on posterointernal slope of main cusp, and well developed but unbasined heel with a single cusp. M₁ with only one heel cusp and no true talonid basin; trigonid about as long as broad, with high protoconid, low paraconid, and intermediate metaconid. M₂ with anteroposteriorly compressed trigonid, metaconid relatively large, paraconid relatively smaller, basined talonid nearly as wide as trigonid, with small entoconid and strong, elevated hypoconid. Anteroexternal cingula on molars, nearly vertical on M₁, more sloping on M₂. Length P₄-M₂ about 4.5 mm.

This very diminutive jaw somewhat resembles that of *Hyrcolestes ermineus* from the same formation. The latter, however, is about 45 per cent. larger, with P₄ higher and more slender and its heel and cuspules less developed, no cingula on M₁₋₂, M₂ with trigonid relatively longer, paraconid relatively higher, talonid more elongate and with larger, less internal entoconid, the hypoconid (broken) probably less dominant, the jaw relatively stouter.

Praolestes appears to be an insectivore and is possibly a leptictid, although its P₄ is less molariform than in the known leptictids with the exception of the quite different *Acmeodon*. M₁ is peculiar and more resembles P₄ of the Leptictidae. This tooth of *Praolestes* must be a molar, however, as it does not belong to the deciduous dentition and is on a level with the fully molariform tooth which follows it, while that which precedes it is as yet only partially protruded.



Fig. 1. *Praolestes nanus*, new genus and species. Part of left lower jaw with P₄ and M₁₋₂. Type. A, crown view. B, internal view. Three times natural size.

¹πρᾱος, meek.

***Pseudictops lophiodon*, new genus and species**

TYPE.—Amer. Mus. No. 21727, part of left lower jaw with P_3 – M_3 .

PARATYPE.—Amer. Mus. No. 21712, part of right upper jaw with two cheek teeth.

CHARACTERS.— P_3 with the protoconid and the somewhat lower metaconid forming a cross crest; paraconid small, anterior and slightly internal to the protoconid; small basined heel with raised posterior rim, obscurely cuspidate. P_4 larger; trigonid essentially a short, transverse crest; metaconid slightly higher than protoconid; paraconid vestigial, anteromedian, united to the protoconid by a small secondary

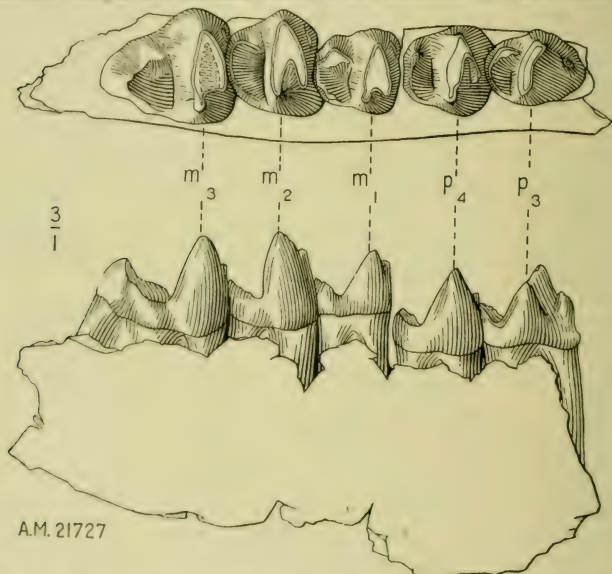


Fig. 2. *Pseudictops lophiodon*, new genus and species. Part of left lower jaw with P_{3-4} and M_{1-3} . Type. Crown and internal views. Three times natural size.

crest; heel low, short, transverse, posterior rim raised, with distinct hypoconid. M_1 smaller than P_4 . M_{1-3} progressively larger. Molar trigonids strongly compressed anteroposteriorly, progressively higher relative to talonids. Paraconids vestigial, united to protoconids by small secondary crests, internal on M_1 , progressively less so on M_{2-3} . Molar talonids basined, narrower than trigonids, short and small on M_{1-2} and with distinct hypoconids, more elongate on M_3 , with elevated hypoconulid, small but distinct hypoconid, and obscure entoconid. P_4 – M_3 with small anteroexternal cingula. Lower jaw of moderate depth, stout transversely.

Known upper cheek teeth (paratype), probably M^{1-2} , strongly transverse, with short, crescentic protocone; conical, high paracone and metacone, bases connate; distinct parastyle, smaller metastyle, narrow anterior cingulum; well marked, basined, non-cuspidate posterior cingulum rising to protocone. P^1 (part of alveolus) probably wider than M^1 . M^2 slightly larger and more transverse than M^1 . M^3 (alveoli) as large as M^2 or larger.

Despite its large size, this genus is suggestive of the Leptictidæ, although this resemblance is not sufficiently close necessarily to indicate true relationship. The molarization of the premolars has gone farther than in any leptictid, the bilophodont lower molars are not very closely paralleled in that group; the cheek teeth of the latter do not increase in size posteriorly as in *Pseudictops*, and their upper molars always have a hypocone which does not closely correspond to the posterior cingulum of *Pseudictops* in its relationship to the protocone.

The Cretaceous *Zalambdalestes* from an earlier formation near the same locality is leptictid in aspect and to that extent resembles *Pseudictops*, but there are no indications of special affinity.

The complication of the premolars, lophiodont lower molars, reduced paraconids, short heels on M_{1-2} , and retention of triangular upper molars recalls the Amblypoda, but the resemblance is even less close than to the Leptictidæ.

Eurymylidæ, new family

PROVISIONAL DEFINITION.—Cheek teeth P_2^2 M_3^3 . Lower incisor fully gliriform, extending far back beneath cheek teeth. Lower cheek series hypsodont, rooted, with elevated trigonids and low talonids, each wearing to a transverse enamel ring. Upper cheek teeth strongly transverse, tritubercular, with a tendency to form anterior and posterior molar cingula. Masseter origin confined to zygoma, insertion not extending forward of posterior end of M_3 . Infraorbital foramen small.

If other members of the family are found, it may well prove that not all of the above characters do apply to them, but there is no doubt that *Eurymylus* should be placed in a family distinct from any previously defined.

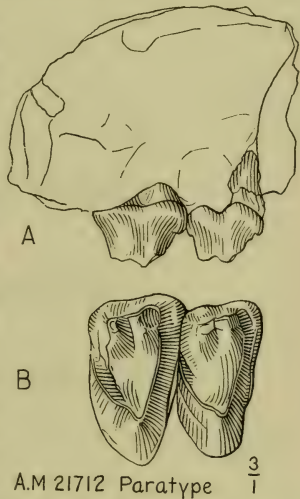


Fig. 3. *Pseudictops lophiodon*; new genus and species. Part of right upper jaw with two cheek teeth. Paratype. A, external view. B, crown view. Three times natural size.

Eurymylus laticeps Matthew and Granger, 1925

SYNONYM.—*Baŋnomys ambiguus* Matthew and Granger, 1925.

Restudy with additional specimens indicates that *Baŋnomys ambiguus* and *Eurymylus laticeps* are respectively the lower and upper jaws of the same species. Published simultaneously, the latter name is selected as definitive, being based on a better type.

Two new lower jaws (Nos. 21735 and 21738) reveal the structure of P_{3-4} . P_3 is a plump tooth implanted by two roots, with an elevated anterior cusp, its apex somewhat transverse and higher externally, a minute cuspule on its anterior side, and a low broad heel which bears a transverse ridge. P_4 is nearly as large as the molars which follow it, and it has an elevated trigonid with two main, blunt, subconical cusps, the



Fig. 4. *Eurymylus laticeps* Matthew and Granger. Left lower jaw with part of incisor, P_{3-4} , and M_{1-2} . Referred specimen. A, crown view. B, external view. Three times natural size.



Fig. 5. *Eurymylus laticeps* Matthew and Granger. Right P_{3-4} , crown view. Referred specimen. Three times natural size.

internal one somewhat the higher. Between these anteriorly is a small cuspule. The heel is low and when unworn has two small transverse ridges united externally. The molars are as described for the type of "*Baŋnomys ambiguus*," and in all cases are too worn to make out the original cusp structure. In No. 21738, P_4 is smaller than in No. 21735, and they may prove to represent distinct species.

Much of the intra-alveolar portion of the incisor is preserved in both of the new specimens and it is seen to be of persistent growth, extending back beneath the molars. Slightly wider than deep, the enamel confined to the broad inferior, or anterior, face, which is flat and bounded by sharp angulations externally and internally.

No. 21737 is a left upper jaw with all the cheek teeth, but it adds little to what was known from the type of *Eurymylus laticeps*. On P_4 a distinct cingulum passes anterior to the paracone, and there is a slight shelf external to this cusp. On M^1 the same features are present, but less distinct, and on M^2 they are not observed. M^{1-2} and probably also P^4 have a definite posterior cingulum which ends in a small cusp posterior and slightly internal to the metacone. On M^3 this feature is still more strongly developed and forms a prominent part of the crown. The region between the protocone and the external cusps is worn in the known material.

The anterior root of the zygoma is above the three anterior cheek teeth. The infraorbital foramen is small and is slightly anterior to the roots of the first cheek tooth.

This genus is so isolated that its affinities remain in doubt. The isolated upper cheek teeth were referred tentatively to the Menotyphla (with *Plesiadapis* and its allies in mind). The lower jaw was referred to the Glires and here left *incertæ sedis*, although compared with the heteromyids on one hand and the lagomorphs on the other. The zygomatic arch is not like that of known rodents, but the evidence in hand does not more strongly favor any other allocation.

If *Eurymylus* is a rodent, it is the oldest known, primitive in many respects, but peculiarly and aberrantly specialized in others. In both upper and lower teeth there is a superficial resemblance to the lagomorphs, but in some characters it is more specialized than even the recent Lagomorpha, and these specializations are in a direction so unlike any known member of the group that it is probable that *Eurymylus* does not belong in the duplicitentate division of the Order. To the non-lagomorph characters of the lower jaw previously mentioned (Matthew and Granger, 1925, p. 6) may be added the fact that the incisor in *Eurymylus* extends far back beneath the cheek teeth. The upper teeth are indeed transverse, but otherwise they show little evidence of lagomorph specialization and, even aside from the absence of P², more definitely resemble the primitive simplicidentates.

The upper teeth do not strengthen the resemblance to the heteromyids. They might conceivably have given rise to those of some members of this family, but the gap is much too great to be filled by inference. There is a more definite resemblance to some of the earlier simplicidentates, such as *Paramys* and its allies, but the differences are striking, and the resemblance, if not wholly deceptive, may indicate only common derivation from the ultimate (Cretaceous) simplicidentate ancestry. The upper cheek tooth formula is the same, and the presence of two lower premolars, while striking, is primitive. Although different in proportions, the tritubercular upper molars with incipient anterior and posterior cingula are not very unlike those of some sciurormorphs, and M³, with its almost basin-like posterior expansion, is more definitely similar. The lower molars have very evident traces of a tuberculo-sectorial ancestry, and their transverse trigonids and sharp division between trigonids and talonids are approached by some sciurormorphs, but the detailed specialization is along unfamiliar lines.

Opisthopsalis¹ vetus, new genus and species

TYPE.—Amer. Mus. No. 21701, very badly crushed skull and jaws.

CHARACTERS.—Dentition $\frac{2, 1, 7, 4, 9}{2, 1, 4, 3}$. Canines moderately developed, laniary. P_4 elevated, carnassial, with distinct paraconid and metaconid and low, unbasined heel. M_1 relatively small, trigonid with subequal protoconid and metaconid and slightly smaller, internal paraconid; talonid slightly narrower than trigonid, basined, with three cusps, the hypoconulid somewhat the highest. M_3 large, with elevated, strongly carnassial trigonid, metaconid (broken in type) apparently present but smaller than paraconid; heel long and narrow, with three cusps, elevated hypoconulid. Jaw slender. P^2 with simple, high, slender crown. M^3 small, transverse, metacone reduced, strong parastylar spur. Length of skull about 60 mm. (much crushed). Brain case very long and narrow, with prominent sagittal and lambdoid crests.

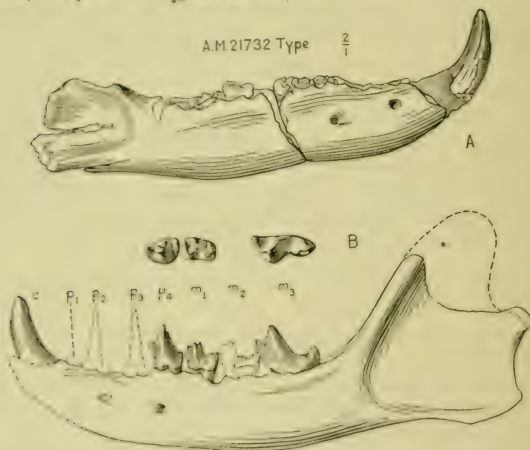


Fig. 6. *Opisthopsalis vetus*, new genus and species. A, right lower jaw with canine, external view. B, left lower jaw with canine, P_4 , M_1 , and M_3 , external view, and crown view of preserved cheek teeth. Distortion of left lower jaw corrected. Type. Twice natural size.

The type of this species is a skull, with articulated lower jaws, nearly complete, but so crushed and broken as to yield few definite characters. The right lower cheek teeth and most of those of the upper jaws were crushed out of place and reduced to minute, irretrievable fragments, but by painstaking separation of the jaws several teeth of the left lower series were exposed nearly in place.

¹*Urocyon*, behind; *Canis*, scissors—in allusion to the carnassial posterior lower molar.

It is possible that this is the same genus as *Sarcodon*, based by Matthew and Granger on a first or second upper molar, but direct comparison is not possible, and the interest of the present specimen demands its separate diagnosis.

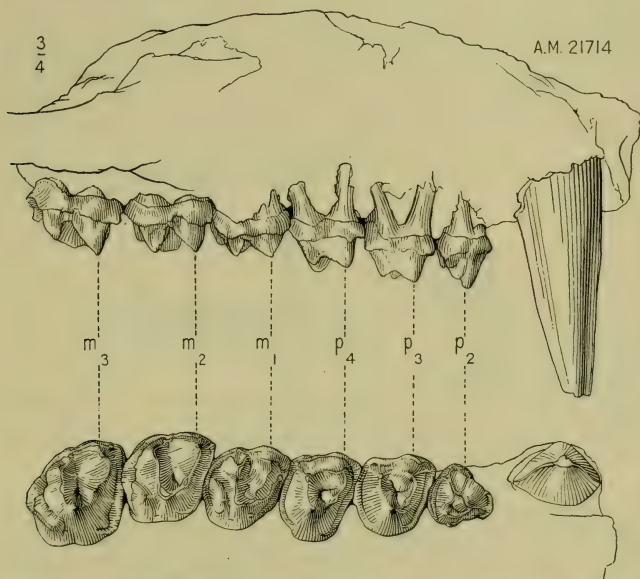


Fig. 7. *Prodinoceras martyri*. new genus and species. Right upper jaw with canine and all cheek teeth, external and crown views. Type. $\frac{3}{4}$ natural size.

There can be little doubt that this small animal is a creodont, but its affinities within this group are doubtful. The large carnassial M_3 suggests the more primitive members of the Hyænodontidæ, and *Opisthopsalis* may be provisionally placed in this family. Both M_3 and M_1 resemble those of *Sinopa* rather more than any other genus, but *Opisthopsalis* differs from any certain hyænodont in the complication of P_4 . This tooth is more nearly, although not exactly, paralleled in the Oxylænidæ, but that family never shows the carnassial specialization of M_3 .

***Prodinoceras martyr*,¹ new genus and species²**

TYPE.—Amer. Mus. No. 21714, crushed palate and lower jaws, with upper canines and cheek teeth and heels of M_3 , right and left, and of M_2 , right.

CHARACTERS.—Canine protruding about 45 mm. from alveolus, nearly straight, tapering evenly to apex, anterior and posterior edges sharp, compressed, external face more convex than internal. P^2 with ectoloph turned inward anteriorly at 45° to tooth row, metacone indicated but not rising free of ectoloph; protocone distinct, lower than metacone, united to paracone by a strong crest and to metacone by a weaker one, enclosing a small basin. P^3 and P^4 similar, the latter larger, distinct metacone and higher paracone, protocone equal to metacone and united to it by a strong, high crest, to paracone by a lower crest with a conule near the protocone, making the

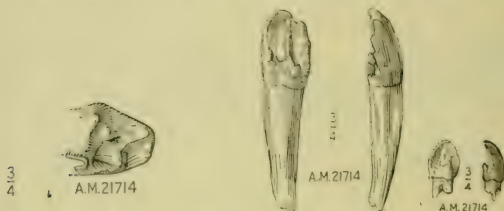


Fig. 8

Fig. 9a

Fig. 9b

Fig. 8. *Prodinoceras martyr*, new genus and species. Posterior part of right M_3 , crown view. Type. $\frac{3}{4}$ natural size.

Fig. 9. *Prodinoceras martyr*, new genus and species. Isolated incisors associated with type. $\frac{3}{4}$ natural size.

crown subquadrate; continuous anterior, external, and posterior cingula, but not continuous across internal base of protocone. M^{1-2} differing from P^{3-4} chiefly in the lower crown, more separate paracone and metacone, and presence of a hypocone directly posterior to the protocone, above the posterior cingulum. M^3 larger, metacone relatively more internal and smaller, anterior and posterior cingula more developed, hypocone more internal, a small cusp posterointernal to it. Talonid of M_3 with high hypoconid, with crest running anterointernally, but heel posterior to this low, postero-medial cusp not elevated. Length P^2 - M^3 , 102 mm.

Prodinoceras is obviously a true uinthere of primitive type, and it is the first indication of this group (as distinct from the coryphodonts) outside of North America.³ It is very closely comparable with an undescribed genus from the Clark Fork Beds, upper Paleocene, of Wyoming, and like the latter it is an almost ideal ancestral type of uinthere so

¹Latin, *martyr*, Greek, *μάρτυρ*, testifier—i. e., to the age of the beds and to the presence of true uintheres in Mongolia.

²*Prodinoceras* Matthew, *Proc. Zool. Soc. London*, 1927 [pub. 1928], pp. 956, 969-970, is the present genus plus that from the Clark Fork, but it was a *genus calceus*, and publication dates from the present paper.

³*Eudinoceras*, from the Irdin Manha, upper Eocene, of Mongolia, proves to be a coryphodont.

far as known. It differs, however, from the Clark Fork genus in details of P^2 , heel of M_2 , and other minor features, which might be interpreted as being very slightly more advanced in the present form and in any event remove it somewhat farther from the later North American genera. As might be expected, the ancestry of the latter is to be sought rather in the Clark Fork form than in that from the Gashato, and although the difference between the two Paleocene genera is slight, *Prodinoceras* appears to be commencing to diverge from the line followed by the American uinatheres.



A.M.21725 Type

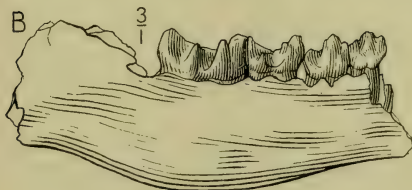


Fig. 10

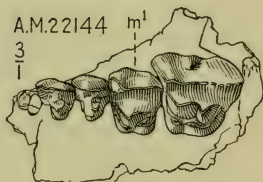


Fig. 11

Fig. 10. *Palæostylops macrodon*, new species. Left lower jaw with P_3 - M_2 . Type. A, crown view. B, internal view. Three times natural size.

Fig. 11. *Palæostylops macrodon*, new species. Left upper jaw with P^3 - M^2 , crown view. Paratype. Three times natural size.

***Palæostylops macrodon*, new species**

TYPE.—Amer. Mus. Nos. 21725, left lower jaw with P_3 - M_2 .

PARATYPES.—Amer. Mus. No. 20416, right lower jaw with I_3 - M_2 , somewhat broken. Amer. Mus. No. 22144, left upper jaw with P^3 - M^2 . Amer. Mus. No. 22142, right upper jaw with M^{2-3} and part of M^1 .

DIAGNOSIS.—Cheek tooth series about 20 per cent. longer than in *P. iturus*, molars relatively narrower, M_2^2 larger relative to other teeth.

In the 1925 collection, *Palæostylops* is very abundant. At least fifty individuals are represented, and they are the most numerous members of the fauna as known. They indicate the presence of a somewhat larger species in addition to the genotype, closely related to the latter but easily distinguished and with intermediate forms absent in the available ma-

terial. The tooth figured by Matthew and Granger (1925, Fig. 4), as possibly indicating a larger species of *Palaeostylops*, does not belong to *P. macrodon*, and its affinities are still uncertain. It does not belong in the upper jaw of this genus.

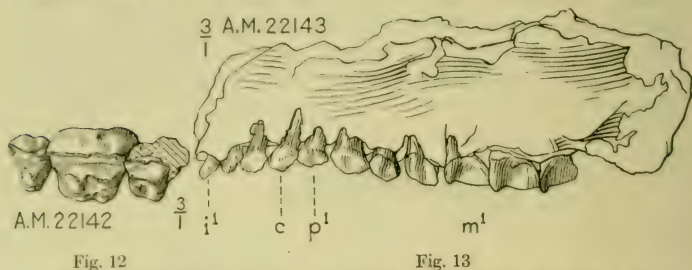


Fig. 12

Fig. 13

Fig. 12. *Palaeostylops macrodon*, new species. Right upper jaw with M^1 ³, somewhat broken, crown view. Paratype. Three times natural size.

Fig. 13. *Palaeostylops iturus* Matthew and Granger. Left upper jaw with complete dentition, external view. Referred specimen. Three times natural size.

***Palaeostylops iturus* Matthew and Granger, 1925**

The only important gap in previous knowledge of the dentition of this species was due to the absence of I^1 -C, but these teeth are now clearly displayed in Amer. Mus. No. 22143, a left upper jaw with the complete dentition. The dental formula is $\frac{3 \cdot 1 \cdot 4 \cdot 3}{2 \cdot 1 \cdot 4 \cdot 3}$. The upper incisors, canine, and premolars form an evenly graded series without any definite morphological breaks. Each of these teeth consists of a simple external wall and an internal heel, sloping and very inconspicuous on I^1 but progressively stronger until on the posterior premolars it forms a sharp internal cusp. Contrary to the inference from its incomplete alveolus, the canine is not larger than I^1 and it is hardly to be distinguished in form from this tooth or from I^3 .

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SOME CHINESE FRESH-WATER FISHES¹

By J. T. NICHOLS²

XIX.—NEW LEUCOGOBIOID GUDGEONS FROM SHANTUNG

With the publication of number XVIII of this series in 1926, it was assumed that most of the obviously new forms of Chinese fresh-water fishes in the collections of the Asiatic Expeditions of The American Museum of Natural History had been reported upon. Considerable attention has since been given to a study of the literature with reference to material already examined. A more critical study of specimens has been resumed only recently in the examination of material obtained at Tsinan, Shantung, in 1924, by a native collector under the direction of Mr. Clifford H. Pope. Herein are found the following forms.

Leucogobio polytænia microbarbus, new subspecies

DESCRIPTION OF TYPE.—No. 9651, American Museum of Natural History, from Tsinan, Shantung, April-June, 1924.

Length to base of caudal, 54 mm. Depth in this length, 3.8; head, 3.4. Eye in head, 3.9; snout, 3.9; interorbital, 3; maxillary, 3.2; depth of peduncle, 2; its length, 1.3; pectoral, 1.6; ventral, 1.8; longest dorsal ray, 1.5; longest anal ray, 1.8; caudal lobe, 1.4. Barbel in eye, 5.

Dorsal, 9; anal, 8. Scales 37-38.

Moderately compressed; head rather blunt; vent a little before anal (about one-fifth the distance to ventral axil); lower parts rounded. Jaws equal; mouth moderately oblique; maxillary not reaching to under front of eye, with a minute subterminal barbel; gill membranes forming a narrow fold across isthmus. No spinous dorsal or anal rays; dorsal origin equidistant from end of snout and base of caudal; ventral origin slightly behind that of dorsal; pectoral rounded, ventral bluntly pointed; pectoral reaching two-thirds the distance to ventral, ventral four-fifths to anal; caudal moderately forked. Scales with close-spaced slightly radiating striae, weaker than their strong concentric markings; lateral line complete, in the middle of side except for a slight rise in front.

Color much as in *polytænia*; a broad dark central stripe, and narrower stripes above and below it. Dorsal with a dark cross-shade, strongest on the front rays.

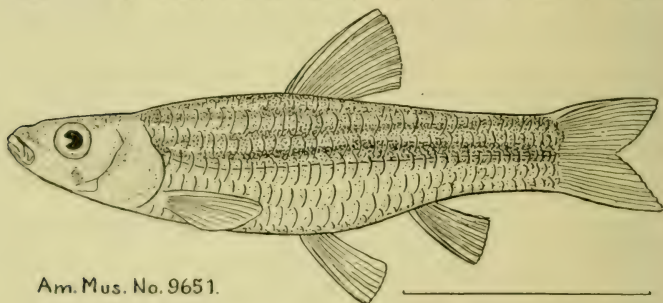
This form is obviously very close to *Leucogobio polytænia* from Shansi (Nichols, 1925, Amer. Mus. Novitates, No. 181, p. 6). Its

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 94.

²Drawings of type specimens by Gleb Botkin.

body form tends to be more pointed in front; its decidedly smaller barbel and other slight differences hold in other specimens in this collection, as follows.

| Standard Length | Depth | Head | Eye | Dorsal | Anal | Scales | Barbel in Eye |
|-----------------|-------|------|-----|--------|------|--------|---------------|
| 61 mm. | 3.9 | 3.6 | 4 | 9 | 8 | 36 | 4.5 |
| 63 | 4.1 | 3.7 | 3.8 | 9 | 8 | 38 | 3.5 |
| 69 | 4.2 | 3.8 | 4.1 | 9 | 8 | 37 | 3.5 |
| 76 | 4.1 | 3.7 | 4 | 9 | 8 | 36 | 4 |
| 81 | 4 | 3.8 | 4.5 | 9 | 8 | 39 | 3.8 |
| 86 | 3.9 | 3.7 | 4.8 | 9 | 8 | 38 | 4.5 |



Am. Mus. No. 9651.

Fig. 1. *Leucogobio polytaenia microbarbus*, type.

Numerous small specimens seem to represent the young of this form. They have a dark lateral band, not very broad, the only conspicuous color marking. A few of the largest measure as follows.

| Standard Length | Depth | Head | Eye | Dorsal | Anal | Scales | Barbel in Eye |
|-----------------|-------|------|-----|--------|------|--------|---------------|
| 29 mm. | 3.7 | 3.6 | 3.5 | 9 | 8 | 37 | 4 |
| 29 | 3.8 | 3.4 | 4 | 9 | 8 | 36 | 4 |
| 30 | 4 | 3.3 | 4 | 9 | 8½ | 38 | 4 |
| 30 | 4 | 3.4 | 4.3 | 9½ | 8 | 36 | 4 |
| 31 | 4.3 | 3.5 | 4 | 9 | 8 | 37 | 3 |
| 31 | 4.3 | 3.6 | 3.7 | 9½ | 8 | 37 | 4 |
| 31 | 4 | 3.5 | 3.8 | 9 | 8 | 36 | 4 |
| 31 | 4 | 3.5 | 4 | 9 | 8 | 36 | 4 |
| 32 | 4 | 3.6 | 4.4 | 9 | 8 | 36 | 4.5 |

Gnathopogon intermedius, new species

DESCRIPTION OF TYPE.—No. 9652, American Museum of Natural History, from Tsinan, Shantung, April-July, 1924.

Length to base of caudal, 65 mm. Depth in this length, 3.7; head, 3.6. Eye in head, 3.7; snout, 3; interorbital, 3.2; maxillary, 3.5; depth of caudal peduncle, 2.7; its length, 2; pectoral, 1.6; ventral, 1.6; longest dorsal ray, 1.4; longest anal ray, 1.8; caudal lobe, 1.4. Barbel in eye, 1.8.

Dorsal, 9; anal, 8. Scales, 36.

Moderately compressed; head rather pointed; vent at three-quarters the distance from ventral axil to anal origin; lower parts broadly rounded. Eye very slightly superolateral; lower jaw slightly included; mouth moderately oblique; maxillary not reaching to below front of eye, with a rather small subterminal barbel; gill membranes narrowly joined to the isthmus under edge of preopercle. No spinous dorsal or anal rays; dorsal origin equidistant from end of snout and middle of peduncle; ventral origin under the middle of dorsal base; pectorals and ventrals bluntly pointed; pectoral reaching two-thirds the distance to ventral, ventral three-quarters to anal; caudal moderately forked. Scales with radiating striae; breast completely scaled; lateral line complete, in middle of side except for a slight rise in front.

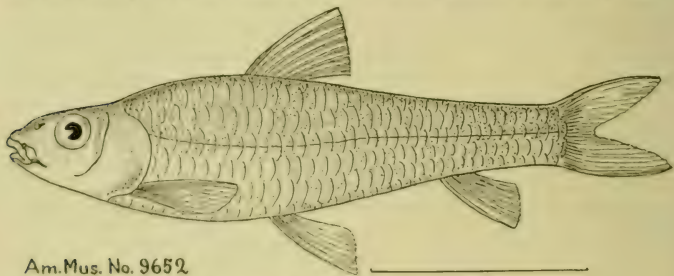
A faint dark shade along the middle of side posteriorly; otherwise unmarked, including the fins.

Measurements of several other specimens are given in the following table.

| Standard Length | Depth | Head | Eye | Dorsal | Anal | Scales | Barbel in Eye |
|-----------------|-------|------|-----|--------|------|----------|---------------|
| 52 mm. | 3.5 | 3.6 | 3.7 | 9 | 8 | 37 or 38 | 1.9 |
| 53 | 3.5 | 3.5 | 3.7 | 9 | 8 | 35 | 1.8 |
| 53 | 3.8 | 3.6 | 3.5 | 9 | 8 | 38 | 2.3 |
| 54 | 4 | 3.4 | 4 | 9½ | 8½ | 35 | 1.9 |
| 58 | 3.4 | 3.4 | 3.8 | 9 | 8 | 36 | 1.6 |
| 59 | 3.6 | 3.4 | 4 | 9 | 8 | 35 | 2 |
| 61 | 4 | 3.8 | 3.8 | 9 | 8 | 36 | 2.5 |
| 62 | 3.5 | 3.5 | 3.8 | 9 | 8 | 37 | 1.8 |
| 63 | 3.9 | 3.6 | 3.7 | 9 | 8 | 37 | 2 |
| 69 | 3.4 | 3.3 | 4 | 9 | 8 | 36 | 1.9 |

The 69 mm. specimen is a female distended with large eggs. In color it has a dark lengthwise shade in the middle of the side and narrower broken stripes above it. It has obscure markings along the lateral line in front suggestive of those most pronounced in *G. wolterstorffi* but also found in other species of this genus; and faint dark marks across the dorsal. It seems to be an abnormal individual, and has the lateral line distinctly bent down in front. The 52 mm. specimen has the lateral line slightly bent down with similar markings.

This form differs from any other examined by the writer and, in view of the number of closely related ones that exist, is probably distinct from *Gnathopogon elongatus* of Japan, though an apparently slightly lower scale count and shorter barbel are poor characters by which to separate it therefrom. It is markedly variable or instable, and also approaches *Leucogobio taniellus* Nichols (1925, Amer. Mus. Novitates, No. 181, p. 7) from Fukien, being intermediate between these two genera of convenience (*op. cit.*, p. 6). A similar instability is noticeable in certain other fishes in the Tsinan collection and seemingly dependent on the locality. If the cause of this instability could be rightly deter-



Am. Mus. No. 9652

Fig. 2. *Gnathopogon intermedius*, type.

mined, this would probably be more interesting than solution of the systematic problem. As it is, each of these two problems complicates the other and renders it more difficult.

There is a single specimen almost sufficiently like *G. intermedius* to be an aberrant individual of it, but with standard gnathopogon characters pronounced, which at the same time is very close to the geographically distant *G. atromaculatus* Nichols and Pope (1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 351) from Hainan. It has a shorter barbel than that species and may be described as follows.

Gnathopogon similis, new species

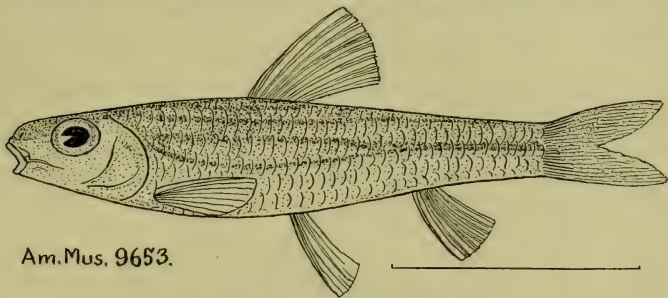
DESCRIPTION OF TYPE.—No. 9653, American Museum of Natural History, from Tsinan, Shantung, April-July, 1924.

Length to base of caudal, 58 mm. Depth in this length, 4.5; head, 3.7. Eye in head, 3; snout, 3; interorbital, 3.4; maxillary, 3.6; barbel, 4; width of body at shoulder, 2; depth of peduncle, 2.6; its length, 1.5; pectoral, 1.4; ventral, 1.4; longest dorsal ray, 1.3; longest anal ray, 1.0; caudal lobe, 1.1.

Dorsal, 9; anal, 8. Scales, 37 to 38.

Moderately compressed; breast and belly rounded; vent at three-eighths the distance from anal origin to ventral axil. Interorbital slightly concave; eye large, oval, slightly superolateral; maxillary slightly oblique, not reaching to under front of eye; lower jaw without free lip, distinctly included; gill membranes narrowly joined to isthmus slightly behind margin of preopercle. Dorsal and anal without spinous rays; dorsal origin equidistant from end of snout and middle of last anal ray; ventral origin under middle of dorsal base; pectoral reaching four-fifths the distance to ventral, ventral three-quarters to anal; caudal well forked, with narrow pointed lobes. Scales thin; body completely scaled; lateral line complete, dipping slightly in front, in the center of peduncle.

Color pale; a small dark spot on dorsal origin; a rather obscure dark stripe in center of peduncle, rising above lateral line over ventral; a faint dark stripe behind the vent, and dark mark at base of each caudal lobe; faint specking along lateral line suggesting *wolterstorffi*. Lower half of opercle bright, with a dark dot above.



Am. Mus. 9653.

Fig. 3. *Gnathopogon similis*, type.

Other gudgeons abundantly represented in the Tsinan collection are *Pseudogobio rivularis* (Basilewskî) and *Pseudogobio chinssuensis* Nichols, the last up to 43 mm. standard length. A *Sarcocheilichthys*, subgenus (*Chilogobio*), is also plentiful, identified as *S. nigripinnis sciistius* (Abbott).

XX.—AN UNDESCRIBED FORM OF *RHODEUS* FROM SHANTUNG

A considerable series of *Rhodeus* from Tsinan shows a tendency to deviate from the standard characters of *Rhodeus sinensis* Günther, but a great majority are clearly referable to that species, with a somewhat lower fin-ray count than is usual, dorsal branched rays 7 to 9, anal 8 to 9, in most cases 8 in the dorsal and 9 in the anal. This species ordinarily has 9 or 10 dorsal and 8 to 11 anal branched rays.

This tendency to few fin-rays is paralleled in a small series (9) of related *Pseudoperilampus ocellatus* Kner from the same locality, with

dorsal branched rays 10 to 11 (in most cases 11), anal 9 to 11 (in most cases 10), instead of being about 12 in both fins.

Occurring with the material referred to *Rhodeus sinensis* above, a number of small specimens are at once differentiable by being more slender, the black rhodein stripe bolder and carried forward to the head in a broader dusky shade from dark scale outlines. Closer examination shows that these have simple dorsal and anal rays more spinous, frequently rather well-developed spines with soft tips, and a ray or two more in the dorsal. Though this last character is normal for *sinensis* it helps to differentiate them from the particular *sinensis* with which they are associated, and the combination of characters seems to require their recognition as a new form. Though possibly an ecological subspecies, this is certainly not a geographic subspecies and is described as follows.

***Rhodeus notatus*, new species**

DESCRIPTION OF TYPE.—No. 9654, American Museum of Natural History, from Tsinan, Shantung, April–July, 1924, male.

Length to base of caudal, 33 mm. Depth in this length, 2.8; head, 4.4. Eye in head, 2.7; snout, 3.4; interorbital, 2.7; maxillary, 3.6; width of body, 2; depth of peduncle, 2.1; its length, 1.1; pectoral, 1.2; ventral, 1.4; longest dorsal ray, 1.2; longest anal ray, 1.4; caudal lobe, 0.9.

Dorsal, II, $9\frac{1}{2}$; anal II, $9\frac{1}{2}$. Scales 32 to 33.

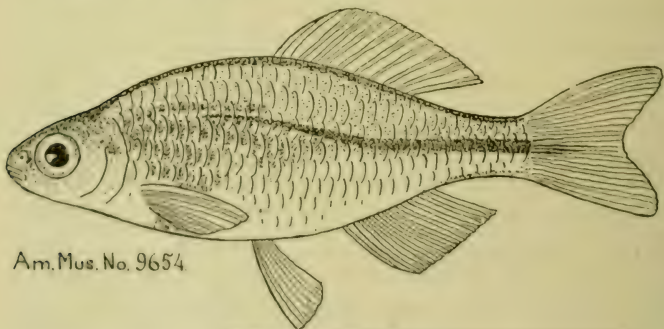


Fig. 4. *Rhodeus notatus*, type.

Body compressed; its outlines evenly convex and the nape not appreciably elevated; vent at about five-eighths the distance from anal origin to ventral axil. Top of head slightly convex; mouth distinctly inferior, maxillary not quite reaching to under front of eye; gill-membranes attached to isthmus under middle of pre-

opercle. Last simple dorsal and anal rays weakly spinous almost throughout with soft tips. Dorsal origin equidistant from base of caudal and middle of snout, immediately behind base of ventrals; anal origin under middle of dorsal base; pectoral reaching about to ventral origin, ventral about to that of anal; caudal well forked. Scales with only faint concentric striae noticeable; lateral line on first five scales.

A bold dark stripe in center of peduncle, continued backward with a narrow break in a dark mark on the middle caudal rays; forward this stripe bends upward, becomes narrower, and is appreciable almost to the head. An obscure dark blotch behind the upper angle of the gill cleft, dark stripe on the snout, and dark shade on the upper part of gill-cover, below which last there is a bright area. Scales on sides anteriorly with dark more or less vertical marks at their borders; breast and belly before the anal dark. Dorsal, anal and ventral fins dusky; the anterior dorsal rays pale distally; the anal pale submarginally, very narrowly black-tipped.

Measurements of additional specimens follow. The fin-count includes 2 simple more or less spinous rays in dorsal and anal.

The females have a black spot on the front of the dorsal fin; only one of the males has such a spot faintly indicated.

| Standard Length | Depth | Head | Eye | Dorsal | Anal | Scales | Sex |
|-----------------|-------|------|-----|--------|------|----------|--------|
| 23 mm. | 2.6 | 3.9 | 2.7 | 11½ | 11 | 31 | Male |
| 26 | 2.9 | 4 | 2.7 | 12 | 11 | 32 | Male |
| 27 | 2.8 | 4 | 2.7 | 12 | 11 | 33 | Male |
| 27 | 2.6 | 4.1 | 2.6 | 11 | 11 | 32 | Female |
| 28 | 2.7 | 3.9 | 2.6 | 11 | 11 | 34 | Female |
| 30 | 2.7 | 3.9 | 2.9 | 11 | 10 | 32 | Female |
| 30 | 2.8 | 4 | 2.7 | 11 | 11 | 33 | Male |
| 30 | 2.9 | 4 | 2.7 | 11 | 11 | About 30 | Female |

XXI. AN ANALYSIS OF MINNOWS OF THE GENUS *PSEUDORASBORA* FROM SHANTUNG

In 1925¹ and 1928² the writer recognized 5 species of *Pseudorasbora* from China, instead of referring Chinese material to one widely distributed form in eastern Asia with type locality Japan. Rendahl (1928)³ discredits this analysis as being based on slight variable characters and inadequate material. The material on which the writer's opinion was based, however, was not so inadequate as one might have been led to suppose. It indicates clearly enough that the variable fish widely known as *Pseudorasbora parva* occurs in several forms, recognizable though hard to define, which are more or less geographic and something more than individual variation. That they are sufficiently well

¹Nichols, 1925, Amer. Mus. Novitates, No. 182, pp. 4-6.

²Nichols, 1928, Bull. Amer. Mus. Nat. Hist., LVIII, pp. 19-20, Figs. 8-10.

³Rendahl, 1928, Arkiv. for Zool., 20A, No. 1, pp. 103-107.

marked to make their taxonomic recognition desirable is, on the other hand, not at all sure, and it will be best for the present to consider them subspecies of *P. parva*.

Examination of a considerable series of *Pseudorasbora* in the Tsinan, Shantung collection, complicates the problem in that there seem to be from this one locality three distinct forms, not at all difficult to pick out from a mixed lot of specimens. The great majority belong to a small short-bodied, broad-headed form, with more than usually heavily pigmented scales, which may be described as *Pseudorasbora parva parvula*, new subspecies.

***Pseudorasbora parva parvula*, new subspecies**

DESCRIPTION OF TYPE.—No. 9655, American Museum of Natural History, from Tsinan, Shantung, April-July, 1924.

Length to base of caudal, 55 mm. Depth in this length, 3.5; head, 3.9. Eye in head, 4.5; snout, 3.5; interorbital, 2; maxillary, 4; width of body, 1.7; depth of peduncle, 1.7; its length, 1.3; pectoral, 1.5; ventral, 1.5; longest dorsal ray, 1.2; longest anal ray, 1.8; caudal, 1.1.

Dorsal, 9; anal, 8. Scales, 35.



Fig. 5. *Pseudorasbora parva parvula*, type.

Body compressed; interorbital broad, very slightly convex; nape slightly elevated. Mouth small, transverse, almost vertical; lower jaw slightly projecting; maxillary not reaching half the distance to eye; no barbels; opercle with a membranous edge; gill membranes joined to breast slightly before middle of opercle; 2 pairs of horny warts on the chin, a row from maxillary back under eye. Dorsal and anal without spinous rays; dorsal origin equidistant from tip of snout and base of caudal, over ventral base; pectoral extending two-thirds the distance to ventral, ventral four-fifths to anal; caudal moderately forked; all fins rounded or bluntly pointed. Scales with inconspicuous radiating striae; lateral line complete, dropping slightly behind opercle, thence straight to caudal base in center of side.

A little darker colored above than below. Central part of each scale dusky. Fins dusky or grayish.

A representative series of specimens measure as follows.

| Standard Length | Depth | Head | Eye | Dorsal | Anal | Scales | Inter-orbital | Longest Dorsal Ray |
|-----------------|-------|------|-----|--------|------|--------|---------------|--------------------|
| 49 mm. | 3.6 | 3.9 | 3.8 | 9 | 8 | 37 | 2.4 | 1.4 |
| 51 | 3.5 | 3.8 | 4 | 9 | 8 | 36 | 2.4 | 1.4 |
| 53 | 3.8 | 3.8 | 4.3 | 9 | 8½ | 36 | 2.1 | 1.2 |
| 53 | 3.7 | 3.8 | 4 | 9 | 8 | 37 | 2.1 | 1.6 |
| 54 | 3.6 | 4 | 4.6 | 9 | 8 | 37 | 2 | 1.4 |
| 55 | 3.9 | 3.9 | 4 | 9 | 8 | 36 | 2 | 1.4 |
| 56 | 3.6 | 4 | 4.2 | 9 | 8 | 37 | 2.1 | 1.3 |
| 57 | 3.5 | 3.9 | 3.9 | 9 | 8 | 37 | 2.1 | 1.2 |
| 59 | 3.5 | 4 | 4 | 9 | 8 | 37 | 2 | 1.4 |
| 73 | 3.4 | 4.2 | 4.5 | 9½ | 8 | 35 | 1.8 | 1.3 |

At a standard length of 50 to 55 mm. this form frequently has horny warts on the face which are relatively somewhat larger, especially those under the eye, than such warts in the following form at 65 to 70 mm. standard length.

***Pseudorasbora parva fowleri*, (Nichols)**

The second form of *Pseudorasbora*, of which a number of specimens are present in the Tsinan collection, seems to be the same as is common in the lower Yangtze Valley. It is usually paler than *parvula*, but sometimes equally dark, so that color is not a good criterion to separate it. The best character seems to be a narrower interorbital in the same-sized *fowleri*. The interorbital gets broader with age, so that there is considerable overlap if the size of the specimen is not taken into consideration. For purposes of comparison, a few Tsinan specimens of *fowleri* measure as follows.

| Standard Length | Depth | Head | Eye | Dorsal | Anal | Scales | Inter-orbital | Longest Dorsal Ray |
|-----------------|-------|------|-----|--------|------|--------|---------------|--------------------|
| 55 mm. | 4.1 | 3.6 | 3.8 | 9 | 8 | 35 | 2.5 | 1.3 |
| 55 | 3.8 | 3.5 | 3.7 | 9 | 8 | 34 | 2.6 | 1.4 |
| 57 | 4 | 3.7 | 3.8 | 9 | 8 | 35 | 2.5 | 1.3 |
| 58 | 3.8 | 3.8 | 3.7 | 9 | 8 | 35 | 2.5 | 1.3 |
| 65 | 3.8 | 4.2 | 3.8 | 9 | 8 | 34 | 2.3 | 1.4 |

Pseudorasbora parva parva from Japan (not seen by the writer) seems to be very close to *fowleri* but with a higher scale count, and probably does not occur in China if these other subspecies be recognized.

***Pseudorasbora parva tenuis*, new subspecies**

The third form of *Pseudorasbora* in this collection is represented by several small specimens readily picked out from a considerable lot of *parvula*, and which also seem different from the young of *fowleri*, to which three or four other specimens in the same lot are referred. They are slender, large-eyed, interorbital broad, much as in *parvula*, dorsal high; and have a narrow black lengthwise stripe more or less developed. A practically identical color marking may, however, be present in the other forms. This would seem to be an ecological rather than a geographic subspecies.

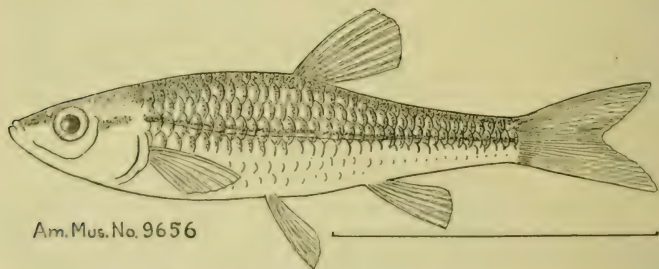


Fig. 6. *Pseudorasbora parva tenuis*, type.

DESCRIPTION OF TYPE.—No. 9656, American Museum of Natural History, from Tsinan, Shantung, summer of 1924.

Length to base of caudal, 41 mm. Depth in this length, 4.3; head, 3.8. Eye in head, 3.3; snout, 3; interorbital, 2.4; maxillary, 4; width of body, 2.2; depth of peduncle, 2.6; its length, 1.3; pectoral, 1.5; ventral, 1.5; longest dorsal ray, 1.1; longest anal ray, 1.6; caudal lobe, 0.9.

Dorsal, 9; anal, 8. Scales 34.

Nape very slightly elevated; snout pointed; mouth oblique; lower jaw slightly projecting; maxillary extending half the distance to under front of eye; gill membranes narrowly joined to breast well behind margin of preopercle. Dorsal and anal without spinous rays; dorsal origin equidistant from end of snout and base of caudal, over ventral base; pectoral reaching three-quarters the distance to ventral, ventral three-quarters to anal; caudal well forked. Scales with well-marked slightly radiating striae; lateral line complete in middle of side, rising slightly at shoulder.

Color darker along the back and paler below; a blackish streak from before eye to base of caudal.

Additional specimens measure as follows.

| Standard Length | Depth | Head | Eye | Dorsal | Anal | Scales | Inter-orbital | Longest Dorsal Ray |
|-----------------|-------|------|-----|--------|------|--------|---------------|--------------------|
| 31 mm. | 4.5 | 3.7 | 3 | 9 | 8 | 35 | 2.4 | 1.2 |
| 32 | 4.5 | 3.6 | 3 | 9 | 8 | 33 | 2.3 | 1.1 |
| 36 | 4.5 | 3.9 | 3 | 9 | 8 | 33 | 2.4 | 1.1 |
| 37 | 4 | 3.7 | 3 | 9 | 8 | 35 | 2.4 | 1.2 |
| 40 | 4.3 | 4.1 | 3 | 9 | 8 | ?34 | 2.3 | 1.1 |
| 40 | 4.3 | 3.7 | 3 | 9½ | 8 | 35 | 2.4 | 1.2 |

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ADDITIONAL NEW FORMATIONS IN THE LATER SEDIMENTS OF MONGOLIA¹

By CHARLES P. BERKEY, WALTER GRANGER, AND FREDERICK K. MORRIS

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INTRODUCTION

During 1925 the Central Asiatic Expedition examined new ground, restudied several districts, and gathered abundant new fossils. It is allowable now to define several additional new formations as another step in the interpretation of the stratigraphy of the Gobi region and as a support to palæontological research.

The so-called "later sediments" of the Gobi region include the nearly horizontal strata which lie above a great unconformity, and so are

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 95.

readily distinguished from the deformed and much modified structures of the peneplaned "oldrock floor."¹ For the purposes of the present paper, it matters little whether the oldest of the later sediments be regarded as Upper Jurassic² or Lower Cretaceous.³ This question will be more fully discussed in another report, now in preparation.

All places mentioned in this paper are shown on the map, Fig. 1.



Fig. 1. Map showing the location of places referred to in this paper. (Based chiefly on the survey by L. B. Roberts in 1925.)

¹Granger, Walter, and Berkey, Charles P. 1922. 'Discovery of Cretaceous and Older Tertiary Strata in Mongolia.' Amer. Mus. Novitates, No. 42. Berkey, Charles P., and Granger, Walter. 1923. 'Later Sediments of the Desert Basins of Central Mongolia.' Amer. Mus. Novitates, No. 77. Berkey, Charles P., and Morris, Frederick K. 1924. 'Basin Structures in Mongolia.' Bull. Amer. Mus. Nat. Hist., Vol. LI, Art. V, pp. 103-127. Berkey, Charles P., and Morris, Frederick K. 1927. Geology of Mongolia. Nat. Hist. of Central Asia, Vol. II.

²Osborn, Henry Fairfield. 1926. Article, 'Paleontology' in Encyclopedia Britannica.

³Berkey, Charles P., and Morris, Frederick K. 1924. 'Basin Structures in Mongolia.' Bull. Amer. Mus. Nat. History, Vol. LI, Art. V, pp. 109-115. Berkey, Charles P., and Morris, Frederick K. 1927. Geology of Mongolia, p. 354.

TABLE OF NEW FORMATIONS

| Period | Formation | Thickness | Sediments |
|------------------|--|-----------|----------------------------------|
| | | (in feet) | |
| Pleistocene | Orok Nor | 10 | Coarse gravels |
| | Tsagan Nuru | 40 | White sands |
| | Khunuk | 130 | Buff sands and clays |
| | Joselungi | 12 | Brown gravel and sands |
| Oligocene | Baron Sog | 30 | White and gray sands and clays |
| | Ulan Gochu | 60 | Red clays |
| | Jirilgo (probably equivalent to Hsanda Gol) | 40 | Red, brown, and gray clays |
| | | | |
| Eocene | Ulan Shireh (possibly Shara Murun) | 300 | Red and gray clays and sands |
| | Elegen | 70 | Gray sands and clays |
| | Kholobolchi | 500 | White and yellow sands and clays |
| | | | |
| Lower Cretaceous | Dohoin Usu | 300 | Red clays, sands |
| | Dubshih | 1000 | Conglomerates, sands |
| | Ochungchelo | 2000 | Clays, sands, conglomerates |
| | Baiying Bologai | 150 | Red clays and sands |
| | Jasu Jergulung (possibly equivalent to Ondai Sair) | 100 | Black paper shales |
| | | | |

LATE MESOZOIC FORMATIONS

At five different localities sediments were found of enough prominence and unity of character to warrant giving them formational designation. It is entirely possible that some of them are simple equivalents of formations already described and more fully defined. But it is more likely that they cannot be matched, and, for present purposes, it is serviceable to treat them as definite formations, recognizing their local rather than their regional significance. Additional studies of the respective faunas will doubtless clear some of the uncertainties of correlation. The list is described, beginning at the base.

JASU JERGULUNG.—About eight miles west of the frontier customs station, Jasu Jergulung, about Lat. 42° 55' N., Long. 109° 40' E., there is an eastward-facing escarpment of typical paper-shales, with abundant *Estheria middendorffi*. The beds may be called the Jasu Jergulung forma-

tion, as no native name could be found for the scarp itself, and they may be correlated with the Ondai Sair.¹ The exposed thickness is about 100 feet. The base was not seen: the top is the Gobi erosion plane.

BAIYING BOLOGAI.—At Baiying Bologai, about 27 miles east of the Yamen Jasu Jergulung, there is a basin of red clays and sands, with indurated sandstone members, in which sauropod bones were found. Physically the beds resemble the Oshih sediments. The base of the Baiying Bologai formation rests unconformably upon the beveled edges of tilted sandstones and conglomerates, belonging to the oldrock floor. Rounded pebbles of Permian limestone were found in the conglomerates, hence they are post-Palæozoic. They were deformed and eroded before the deposition of the Baiying Bologai. Tentatively, the conglomerate-sandstone series has been assigned to the Jurassic. The Baiying Bologai formation is beveled by the Gobi erosion plane, and hence its upper limit is unknown. Its thickness is at least 150 feet, and may be considerably more.

OCHUNGCHELO.—Along the northern foot of the Gurbun Saikhan mountains there are upturned conglomerates, sandstones, sands and clays, with a few thin beds of inland-water limestone. Near Ochungchelo, at the front of the Dundu Saikhan range, a single sauropod bone was found, indicating either the Lower Cretaceous or the Upper Jurassic age of the sediments. Beginning with conglomerates, the section passes into redbeds, chiefly clays, about 1,000 feet thick. They are succeeded by gray beds, more than 1,000 feet thick, consisting chiefly of clays, with thin sandy layers and minor limestone lenses. Many of the beds are limy and hard; some are shattered, and the fractures are healed with carbonate veins. The strata are tilted along the mountain front, dipping as much as 48° . Dips of 40° continue for over 2,000 feet out from the mountain face, and minor faults traverse the formation.

The prevailing fineness of grain, and the regular and thin bedding, render it quite impossible for the Gurbun Saikhan ranges to have been prominent when these beds were laid down. It is more probable that much, if not all, of the site of the present mountains was covered by the deposits of later Mesozoic time, a suggestion that is strengthened by the great thickness of the upturned beds. In other reports² we have postulated a sedimentary cover of the Gurbun Saikhan during Lower Creta-

¹Cockerell, T. D. A. 1924. 'Fossils in the Ondai Sair Formation, Mongolia.' *Bull. Amer. Mus. Nat. Hist.*, Vol. LI, Art. VI, pp. 129-144. Berkey, C. P., and Morris, F. K. 1927. *Geology of Mongolia*, pp. 290, 354.

²Berkey, C. P., and Morris, F. K. 1924. 'Basin Structures in Mongolia.' *Bull. Amer. Mus. Nat. Hist.*, Vol. LI, Art. V, p. 118. Berkey, C. P., and Morris, F. K. 1927. *Geology of Mongolia*, pp. 316-317.

ceous time, basing the inference chiefly upon studies of the Djadokhta and Gashato beds.

The base of the Ochungehelo rests directly upon the complex old-rocks of the Gurbun Saikhan. The edges of the tilted strata are smoothly beveled by the Gobi erosion plane. The northward dip, if the formation continues far out into the basin, would carry it underneath the Djadokhta and Gashato formations. It may, therefore, be essentially equivalent to the Dubshih formation next to be mentioned, which certainly lies immediately beneath the Djadokhta formation at the westerly border of the district.

DUBSHIH.—About 14 miles west of our camp at Shabarakh Usu in the Djadokhta district, there is a broad dry valley called Baron Ghi Usu, tributary to the still larger Shabarakh valley. On the east side of the channel a mesa of rhyolite and basalt, called Dubshih, forms the most prominent landmark for many miles. The name, Dubshih Gashuin Bologai, is given to an important spring on the main caravan trail, three miles east of the mesa. In the dissected ground between Dubshih mesa and the spring, Dubshih Gashuin Bologai, there is a series of tilted strata which forms a stratigraphic unit, and which has been designated as the Dubshih formation.

The beds dip eastward at angles varying up to 20° . The steepest dips are found in the western, or lower, beds, near the mesa, but in the mesa itself the lava flows lie horizontally. The higher beds dip at progressively smaller angles until they become sensibly horizontal. It is estimated that the thickness cannot be less than 1,000 feet, and it is probably more, since the base of the formation is not exposed and the nearest exposure of the oldrock floor is fifteen miles to the northwest.

The sediments here include two members: a lower group of pebble conglomerates, sandstones, and thin white limestones, all together totaling at least 530 feet; and an upper group, made up chiefly of coarse rubble, rhyolitic tuff and ash but including also conglomerates with pebbles derived from older sediments and porphyries. This member is nearly 300 feet thick.

In the lower conglomerates the pebbles are chiefly of fine-grained phyllite, with fairly abundant limestone pebbles, some of which bear Palaeozoic fossils. Less abundant are quartz, jasper, graywacke, and silicified ash, or argillite. The limestones consist of a fine-grained white lime mud, like marl, which includes varying amounts of sand. Dense white marly masses like concretions are present in some layers. The white lime beds contain shells of a small pelecypod and a gastropod.

Our collection has been sent to Professor Grabau for study. No reptile bones were found.

The base of the Dubshih is not exposed; its top passes under the typical fine red sands of the D'adokhta formation, marking an abrupt change in the character of the sediments. The entire exposure of the Dubshih formation occupies but twelve square miles. The faulting and tilting indicate a history similar to that of the Ochungehelo, Oshih and Ondai Sair units; and the position of the Dubshih beneath the D'adokhta formation suggests that it belongs to the Lower rather than to the Upper Cretaceous. It is, in part at least, equivalent to the Ochungehelo, but it is more complex and quite different in physical character as well as in fossil content. On these counts, it deserves special definition.

DOHOIN USU.—In 1925 Granger discovered a large basin of Cretaceous beds near the well, Dohoin Usu, at approximately Lat. $44^{\circ} 14' N.$, Long. $104^{\circ} 19' E.$, or 40 miles northeast of the eastern end of the Gurbun Saikhan range. He estimates that at least 300 feet of beds are exposed. The base of the formation was not seen, and the upper limit is the Gobi erosion plane, so that the original thickness must be greater than the present exposures. The sediments are chiefly brick red, sandy clays, exposed in badland bluffs along two promontories that front one another across a narrow intervening lowland.

The only fossils were found in a flat lens of bluish gray, sandy clay, 10 to 50 feet thick, in the red clay of the northern promontory. Granger collected pelecypod shells and bones of turtles, crocodilians and iguanodont dinosaurs—clearly a water-loving fauna. No sauropods were found, and the presence of iguanodonts suggests a relation with the Iren Dabasu biota rather than with that of Ondai Sair, Oshih, or Baiying Bologai. For this slender reason, and until the bones shall have been studied, we would place the Dohoin Usu formation near the Iren Dabasu in the column, without attempting any definite correlation.

TERTIARY FORMATIONS

In discussing the newer Tertiary deposits, it seems advisable to depart from the order of time sequence in a few cases so as to emphasize the structural relations of a locality. The individual formations are given their proper position in the geologic column, page 3. The first of the complex localities is the valley of Khunuk, east of the lake, Kholobolchi Nor.

THE KHOLOBOLCHI LAKE DISTRICT

KHOLOBOLCHI.—Possibly the oldest true Eocene beds thus far

found belong to the Kholobolchi formation, outcropping at several places in the Khunuk Valley (Fig. 2).

The first section studied lies at the southern end of the Khunuk valley. Here a series of white and yellow arkosic sands and drab clays



Fig. 2. Sketch map of the area between Kholobolchi Nor, Orok Nor, and Khunuk valley, showing (1) the faulted lowland or graben of Orok Nor, lying between the porphyry hills of the oldrock floor and the Altai range, Ikhe Bogdo, (2) the uptilted oldrock floor, exposed in the chain of porphyry hills; (3) the overlying Tertiary and Pleistocene sediments. (Based chiefly upon the survey by L. B. Roberts and F. B. Butler).

rests directly upon the planed surface of complexly folded rocks of undetermined age, belonging to the oldrock floor (Fig. 3). The later sediments dip northward, and are overlain by buff-colored sands, gravels and silts of Pleistocene age. The lower group of sediments is here between 200 and 300 feet thick, basing the calculation upon the dip and width of exposed outcrop. Skulls of coryphodonts and bones of other mammals were found here, indicating Eocene age, but until the bones are studied it will not be possible to compare the Kholobolchi beds with other formations. The biota is apparently different from any yet seen in Mongolia.

The same sediments can be traced northward for over 20 miles, as the lowest beds exposed in the Khunuk valley. The northern exposures, which are 157 feet thick, also yielded bones, chiefly of perissodactyls. The name, Kholobolchi formation, was assigned these beds, for, although their outcrops are several miles east of the lake, Kholobolchi Nor, the lake is known throughout the district and is the explorer's readiest guide in reaching them. The beds certainly extend beneath the lake itself.

KHUNUK.—The overlying buff beds (Fig. 3) range in thickness from 27 to 127 feet. Because they crown the bluffs along almost the entire west wall of the Khunuk valley (Fig. 2), they are called the Khunuk formation (pronounced Khoon-ook). They include fine buff silts, sandy clay or silt, and arkosic sands and gravels, commonly cross-bedded and locally cemented to form thin sandstones. The lower beds are of finer grain, while the sands and gravels increase in the higher portions. Some of the silty beds are very massive, and may well be windborne dust or loess. The cross-bedding in the sands and gravels is exclusively of stream type, with a prevailing southward dip, indicating that the source of the material was in the north—not in the Altai range to the south. Bones of horses, rhinoceros and a large mastodont clearly indicate Pleistocene age for the Khunuk formation.

OROK NOR.—The base of the Khunuk formation rests on a rolling erosion surface (Fig. 3). The top of the formation is capped by the familiar gravels of the Gobi upland, but as they are 5 to 10 feet thick here and yielded chipped flints which were studied by N. C. Nelson, it has seemed well to give them a name. Accordingly the name, Orok Nor formation, is assigned to the gravels above the Khunuk. The two are separated by a distinct plane where the contact could be seen, and the Orok Nor gravels, at least locally, show cross-bedding and channel-filling. As such washed gravels are not forming anywhere on the Gobi upland at the present time, and as the entire cutting of the Khunuk valley must have

taken place since they were laid down, we judge that the upland gravels are of Pleistocene age. They belong to an epoch of deposition, separated from the present by an epoch of stream erosion.

JIRILGO (probably equivalent to the Hsanda Gol formation).—Three miles north of the southern exposures of the Khunuk buff beds, a new formation is found, intercalated lens-like between the Khunuk and the Kholobolchi (Fig. 3). It consists of massive red clay, without visible bedding, and attains a thickness of about 40 feet, thinning out, wedge-like, within less than a mile. It is capped by a flow of basalt, about 20 feet thick at most, which likewise thins out north and south. The basalt platform, on which the buff beds rest, is called Jirilgo by the Mongols, and we at first proposed this name for the associated red clays.

A little over two miles north of the Jirilgo lens, another lens of similar clay comes in, at the same horizon but without a basalt sheet. About two miles still farther north, red clays again appear, and attain a thickness of 62 feet. Here Granger found fossils which he considers belong to the Hsanda Gol fauna. As the red outcrops were traced eastward across the valley, and as the typical Hsanda Gol fossil-beds are exposed only 20 miles farther east, Granger proposed to call these beds

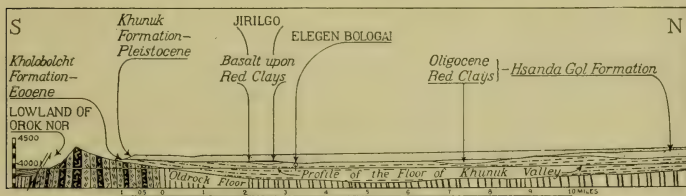


Fig. 3. Generalized geologic section along the western side of Khunuk valley. The vertical scale is five times the horizontal. The Orok Nor gravels are too thin to be plotted on this scale, and are represented by the line which bounds the top of the Khunuk formation. Where the northernmost exposure of the Hsanda Gol formation is indicated, the position of the problematic Elegen formation is indicated by a dotted line between the Hsanda Gol and the underlying Kholobolchi formations

also the Hsanda Gol, abandoning the field name of Jirilgo. But if the detailed study of the fauna should require a separate name for the red beds of Khunuk valley, the name Jirilgo should be retained as a convenient local name.

ELEGEN.—At the northern badlands, we measured 70 feet of arkosic sands, gravels and clays, chiefly of gray color, with a few red layers,

underneath the typical red Hsanda Gol clay and overlying the brown, drab clays and white and yellow sands of the Kholobolchi. No fossils were found in them, but they are sharply delimited from the Jirilgo (Hsanda Gol) red clays, and they are different from the Kholobolchi in texture, color, and details of erosion habit. In the field we considered that they might constitute a separate stratigraphic unit, and called them the Elegen formation, from the spring, Elegen Bologai.

If the beds prove to be a part of the Kholobolchi formation, the name, Elegen, must be abandoned, but we may retain it tentatively as the name for a group of beds that appears to form a distinct unit. In the field, it was the opinion of Morris that the Elegen should even include 35 feet of brown clays which lie at the top of the Kholobolchi formation. Bones were found in a channel filling of sand in the brown clays, the study of which will decide this question.

THE SHARA MURUN DISTRICT

At Shara Murun and Ula Usu, where Granger discovered fossil bones in 1922 and where the Expedition camped in 1923, two formations had been recognized—the lower Tukhum beds of hard red clay, distinguished

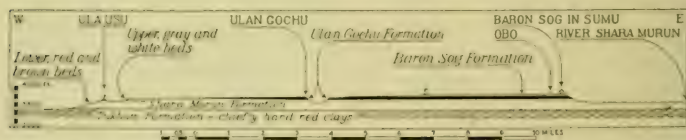


Fig. 4. Generalized cross section between Ula Usu and the Shara Murun valley. The vertical scale is five times the horizontal. The upland gravels, the Joselungi formation, are too thin to be plotted separately, and are represented by the line bounding the upland from the words "upper gray and white beds" to the eastern edge of the escarpment at Baron Sog in Sumu. It will be seen that the Joselungi gravels rest successively upon the Baron Sog, Ulan Gochu and upper Shara Murun formations.

by *Teilhardia pretiosa*, and the overlying Shara Murun beds of varicolored clays with a rich Upper Eocene fauna.¹ At that time, no detailed studies had been made of the eastern bluffs north of Baron Sog temple, or of the large red mesa north of the Tukhum lowland.

The base of the Shara Murun formation rests, with a clearly defined contact, upon the hard red clays of the Tukhum formation.

¹Matthew, W. D., and Granger, Walter. 1926. 'Two New Perissodactyls from the Arshanto Eocene of Mongolia.' Amer. Mus. Novitates, No. 208. Berkey, C. P., and Morris, F. K. 1927. Geology of Mongolia, pp. 346, 367.

ULAN GOCHU.—Traced eastward along the northward-facing front of the scarp, the typical light-colored clays and sands of the upper Shara Murun formation pass beneath a wedge-shaped mass of red clay which ranges from only two feet in thickness where it first becomes visible, to 60 feet at a bold bluff called Ulan Gochu (Fig. 4). In 1925, Granger found fossils in the red clays exposed in the badlands east of Ulan Gochu. The fossils are of Oligocene age, and include titanotheres and some new perissodactyl genera. The red beds continue eastward and southward along the front of the bluff (Figs. 1 and 4) for at least four miles from Ulan Gochu.

BARON SOG.—Overlying the red clays are light gray clays and fine cross-bedded sands. Some beds contain white marly concretions. Like the Ulan Gochu, the gray beds thin out westward and disappear, while they can be traced indefinitely toward the east and south (Fig. 4). The temple, Baron Sog in Sumu, and the large obo of the same name are built upon the gray formation, and it seems well to define it as the Baron Sog formation. Granger found in this formation an Oligocene titanotheria fauna of younger aspect than that of the Ulan Gochu. The greatest thickness measured by the geologists is 27 feet, but in the poorly exposed portions toward the east and south, it is probably thicker. The Baron Sog rests with a clear-cut, smooth contact upon the red Ulan Gochu, and is overlain by the gravels of the Gobi upland.

JOSELUNGI.—These Gobi upland gravels are themselves crossbedded and show channel fillings. They are clearly stream deposits, but no streams are possible on the upland now; they must have been laid down before the deep and wide lowlands of Tukhum and Shara Murun were excavated (Fig. 4).

We judge the upland gravels to be of Pleistocene and possibly in part of Pliocene age; they are locally as much as 12 feet thick. It is not impossible that fossils may be found in them and thus define them more clearly. They form a superficial structural unit for which the name of the upland, Joselungi, may be proposed. It is possible that this superficial deposit does not deserve a definite formational name.

As shown in the section (Fig. 4), the Joselungi gravels rest successively on the Baron Sog, the Ulan Gochu, and the Shara Murun formations, lying on an erosion surface that bevels them all.

ULAN SHIREH (probably equivalent to the Tukhum formation).—North of the bluffs that include the formations just mentioned, there is a system of broad lowlands which has been but slightly investigated.

The eastern portion of the streamless lowland of Tukhum is tributary to the valley of the Shara Murun, an active though shrunken river.

No fossils have been found in either lowland, although there are exposures near the foot of the bluff. North of the Tukhum lowland, there is a red-cliffed mesa called Ulan Shireh, and here, in 1925, rich fossil beds were discovered. The beds are dominantly red clays, though gray clays, sands, and gravels were seen in the western part of the mesa. They form a distinct physical unit. The visible thickness is at least 150 feet (the base has not been seen) and the upper limit is the Gobi erosion plane. Correlation with the formations of the southern bluff must await the determination of the fossils. For the present the name Ulan Shireh is proposed.

East of the Shara Murun valley the sediment basin continues for over 50 miles to the place where the granites and graywackes of the old-rock floor become visible at Boltai Urtu. Splendid exposures in cliffs have been seen at a distance, to the east. These were examined in 1928, and the sequence was found to be the same as on the Baron Sog Mesa.

TSAGAN NURU.—At the Hung Kureh, Granger reports that the huge mastodon pelvis was found in white sands and clays that fill a channel carved in the typical Hung Kureh beds. This fact of superposition indicates post-Hung Kureh age, and the mastodon, according to Granger, is of a Pleistocene type. The geologists did not visit the site of Granger's discovery, and the question of whether the channel filling is to be correlated with the Gochu remains unsolved. The bluffs are called Tsagan Nuru by the Mongols, and we, therefore, assigned this name to the Pleistocene sands and clays. The sediments are strikingly different from the heavy dark rubbles of the Gochu formation already reported, and the name, Tsagan Nuru, will probably stand the test of future investigations.

In concluding this brief review, it is noteworthy that every period except the Miocene represented by the so-called "later" sediments has added new horizons. The Miocene, as in our earlier studies, has slight representation in the record of the later sediments. Unless subsequent expeditions discover more Miocene formations, our earlier inference, that the Miocene was characterized by widespread erosion, will be strengthened.¹

¹Berkey, C. P., and Morris, E. K. 1927. *Geology of Mongolia*, pp. 346, 367.

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PLIOCENE BEDS OF THE IREN GOBI¹

By L. ERSKINE SPOCK

INTRODUCTION²

The purpose of this paper is to place on record the finding of Pliocene strata containing a rich and varied vertebrate fauna in the eastern part of the Iren Tala of Mongolia by the Central Asiatic Expedition of the American Museum of Natural History in 1928. Pliocene beds had already been described by P. Teilhard de Chardin³ in the region of Dalai Nor, and in Southern Inner Mongolia by Andersson,⁴ but their existence in Central Mongolia had not been known previously. In 1922 the name Hung Kureh⁵ was applied by the members of the expedition to fossiliferous beds of Pliocene age discovered at the base of the Baga Bogdo, in the Altai region of Western Mongolia.

During the 1928 field season, the Central Asiatic Expedition spent in all several weeks exploring the country which lies east of the main Kalgan-Urga trail. The region had never been visited before by the Expedition and was first crossed in June by a reconnaissance party in search of new fossil fields. On the second day of this exploration (June 19), vertebrate remains were found near Gur Tung Khara Usu (Fig. 1) in more than sufficient abundance to justify detailed investigation by the entire Expedition. Later in the season, during July and August, the country was explored more carefully and many fossils were collected.

THE IREN GOBI

In the central part of the Iren Tala,⁶ the lowest region of the Gobi desert, there extends a wide area of the "later sediments," covering several thousand square miles. For this great basin the name Iren Gobi

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 96

²The general geologic setting of Mongolia and the methods of study which served as a basis for the present work have already been described. Berkey, C. P., and Morris, F. K. 1927. "Geology of Mongolia," Natural History of Central Asia, Vol. II.

³Teilhard de Chardin, P. 1926. 'Etude Géologique sur la région du Dalai-Noor.' Mém. de la Soc. Géol. de France, No. 7.

⁴Andersson, J. G. 1923. 'Essays on the Cenozoic of Northern China.' Mem. Geol. Survey of China, Series A, No. 3, pp. 36-52.

⁵Berkey, C. P., and Morris, F. K. 1927. 'Geology of Mongolia.' Natural History of Central Asia, Vol. II, pp. 233-236, 365-366.

⁶Berkey, C. P., and Morris, F. K. 1927. 'Geology of Mongolia.' Natural History of Central Asia, Vol. II, pp. 206, 207.

is here suggested, the name being taken from Iren Dabasu, the first discovered of many fossil fields which have been examined by the Central Asiatic Expeditions within the borders of the basin. The sediments, nowhere believed to be more than 1,000 ft. thick, occupy a broad shallow depression formed by the downwarping of the ancient deformed and peneplaned rocks which comprise the desert floor.¹ The peneplane surface on which the sediments rest was formed in pre-Cretaceous



Fig. 1. Sketch map of the Iren Gobi showing principal fossil localities. Contacts shown by broken lines are inferred and subject to correction.

time; the basin-warping began in the Cretaceous period and presumably has been active in an intermittent fashion through most of the time which has elapsed since the initial warping. Iren Gobi sediments do not present a complete succession of strata, but have been deposited and eroded in response to changes produced by differential warping and fluctuations in climatic environment. The Eocene and Pliocene are well represented by both sediments and fossils. The Cretaceous and Oligocene beds contain a rich fauna but are restricted in thickness. Miocene beds have not yet been discovered and the Pleistocene record is but poorly preserved.

¹Berkey, C. P., and Morris, F. K. 1924. 'Basin Structures in Mongolia.' Bull. Amer. Mus. Natural History, Vol. LI, Art. V, pp. 103-127.

The outline of the Iren Gobi is roughly elliptical, with its longer axis trending NE-SW in parallel alignment with the main structure lines of this part of Asia. In crossing the desert by the Kalgan-Urga trail, Iren Gobi sediments are first encountered at P'ang Kiang,¹ from which place they continue northward to Iren Dabasu with only minor local interruptions.

The western and central parts of the area in question are fairly well known, and have been studied by members of the Expedition during all four field seasons (1922-3-5-8). Strata of Cretaceous, Eocene and Oligocene age were recognized in 1922² and have yielded large collections of fossils. Recent exploratory traverses indicate that these fossil localities and their surrounding sediment are to be considered part of the same basin and continuous in a geographic sense with the Pliocene strata of the eastern part of the Iren Gobi.

PLIOCENE SEDIMENTS

Pliocene sediments are spread over the eastern and northeastern area of the Iren Gobi. Since the eastern margin of the Iren Gobi has not been seen by the Expedition, the boundaries of the Pliocene cannot yet be determined; nevertheless sediments of this age are known to occupy several thousand square miles. They differ materially from the Cretaceous and earlier Tertiary sediments in being largely of lacustrine origin. This is essentially the condition in the eastern part of the area, centering about the lake district of Ungur Tsagan Nor. To the west and south, notably at P'ang Kiang, most of the Pliocene deposits are stream-laid and closely resemble the earlier, better-known Tertiary strata. The lacustrine and fluvial beds grade into each other laterally with an imbricating and mutually overlapping contact which may well be attributed to the fluctuating size of the lakes in which the sediments of the eastern area were laid down. Apparently the Pliocene climate was characterized by marked changes in rainfall. It is worthy of note that fossils have been discovered only where there is an alternation of stream and lake deposits, and no organic remains have yet been found where there is an uninterrupted sequence of beds of the same origin. From this mode of distribution and from other supporting evidence, the fauna is believed

¹Berkey, C. P., and Morris, F. K. 1927. 'Geology of Mongolia.' Natural History of Central Asia, Vol. II, pp. 52-55.

²Granger, Walter, and Berkey, C. P. 1922. 'Discovery of Cretaceous and Older Tertiary Strata in Mongolia.' American Museum Novitates, No. 42.

Berkey, C. P., and Granger, Walter. 1923. 'Later Sediments of the Desert Basins of Central Mongolia.' American Museum Novitates, No. 17.

Berkey, C. P., and Morris, F. K. 1927. 'Geology of Mongolia.' Natural History of Central Asia, Vol. II, pp. 182-183, 196-212, 355, 359-362, 364.

to have had a lake-shore habitat. The lacustrine deposits consist of light-colored (white, gray and buff) sands and clays with considerable marly limestone. The fluvial material is commonly coarse gravel and brick-colored silts and clays. In the northwest, the Pliocene is underlain by Eocene beds; elsewhere it rests directly on the pre-Cretaceous peneplane developed on the ancient rocks.

Over large areas the Pliocene beds lie undisturbed and horizontal. They are nowhere covered by later deposits. During the formation of the Gobi erosion plane, no appreciable residual material was left as a



Fig. 2. Type locality of the Pliocene Tung Gur formation. The scarp in the background is formed by a layer of resistant limestone. The fossil in the foreground is a rhinoceros.

capping, a condition in which these beds differ considerably from the earlier Tertiary and Cretaceous deposits of the Iren Gobi. Their maximum thickness is on the order of 500 ft.

THE TUNG GUR FORMATION

The Tung Gur formation is the only Pliocene formation named during the 1928 season. Its type locality and the surrounding country form the only region yet discovered in the Iren Gobi where Pliocene fossils are both well preserved and abundant. On the scarp some three and a half miles north of the well known as Gur Tung Khara Usu

fossils occur at several horizons, in each case embedded in a rather coarse matrix of sand. This material is in part firmly cemented and in many places highly cross-bedded. Associated beds of clay and limestone are barren. Lack of continuity and a pronounced lens-like form are the outstanding characteristics of the beds. The bivalves noted in the faunal list occur in the coarse sandstone together with the mammalian remains. The general relations of the beds and the position of the fossils are indicated in Fig. 4.



Fig. 3. Pelecypod shells in the Tung Gur formation west of Gur Tung Khara Usu.

The following is an abridged preliminary list of the fossils collected in the locality as supplied in the field by Mr. Granger:

- Mastodonts¹, 2 genera, including *Amebelodon grangeri* Osborn
- Canid
- Rhinocerid
- Cervid
- Antelope cf. *Gazella*
- Turtles
- Pelecypods, at least three species.

¹Osborn, H. F. 1929. 'The Revival of Central Asiatic Life.' Natural History, Vol. XXIX, No. 1, pp. 12, 15, 16.

Thirty miles to the southeast, on the lip of the great depression of Tairum Nor, the same formation is exposed on the face of a precipitous scarp (Fig. 5). Although the fossils are the same types as those discovered at Gur Tung Khara Usu, the sequence of beds is quite different. The scarp is composed largely of red clays, divided horizontally by a lens of coarse river deposits and capped by a heavy gravel member. The fossils are contained in the upper gravel and less abundantly in the clay and lower gravel, but the pelecypods so common at Gur Tung Khara Usu are absent. The same sequence of beds has been observed on the south side of the Tairum Nor depression and also farther to the east

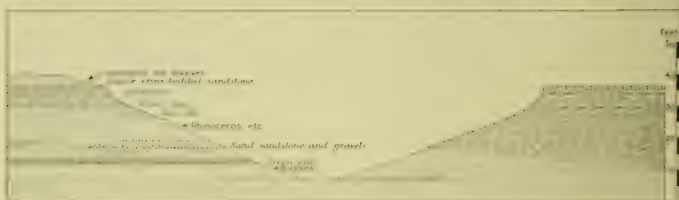


Fig. 4. Section of the Tung Gur formation at the type locality.

near Goshu-in-Sumu. No fossils have been obtained from the two places last mentioned, but it is not improbable that they may be found in the future, since the scarps in the general region of Tairum Nor have a total length of more than 25 miles and have not been fully prospected. Farther to the east, a few fragments of bone of sufficient diagnostic value to determine the Pliocene age were found by Mr. Granger on the Barro Unduh upland, but there was no evidence of extensive deposits of fossils. To the east and south of this point, the Pliocene consists entirely of lake-deposited sands, clays and limestones which are completely barren at the places examined by the Expedition.

In view of the thickness and extent of the known Pliocene deposits east of the Kalgan-Urga trail, it seems quite probable that the beds of the Pang Kiang¹ formation may be a lateral southward continuation of the Tung Gur and associated Pliocene formations. This tentative correlation is made on structural grounds only, for as yet no diagnostic fossils have been found in the Pang Kiang beds. This question will be taken up in a later publication.

¹Hervey, C. P., and Morris, F. K. 1927. 'Geology of Mongolia.' Natural History of Central Asia, Vol. II, pp. 52-55 and 276.

LATER HISTORY

Over most of the region underlain by Pliocene deposits, the Gobi erosion plane is developed in a high stage of perfection and one may travel for many scores of miles in a straight line over monotonously level plains with seldom a break even on the horizon. The preservation of the erosion surface is remarkable in that the Pliocene uplands are not normally protected by resistant layers of cap-rock nor by the equally

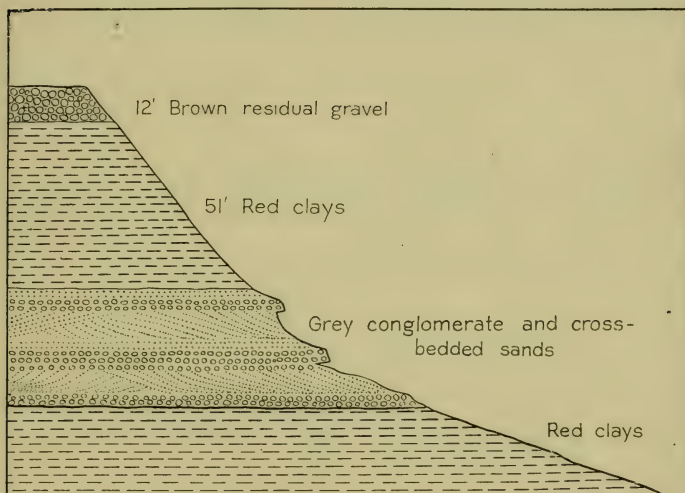


Fig. 5. Section of the Tung Gur formation on the north side of the Tairum Nor depression.

durable accumulations of residuary gravels which are the rule in the central and western portions of the Iren Gobi. To the west and north the beds are undergoing destruction; they are encroached upon by the constant enlargement of the inner lowland which separates them from the oldrock basin rim of the Iren Gobi, and by the equally rapid expansion of the lowland hollows of Tairum Nor and P'ang Kiang. In the easternmost part of the region seen by the expedition, the surface is pitted by a great group of depressions forming the lake district of Ungur Tsagan Nor.

The lake bottoms commonly occur at elevations from three to four hundred feet below the surface of the Gobi erosion plane; the slopes which separate the lake bottoms from the upland are cut into steps by a complicated series of lake terraces (Fig. 6). Here is a record of Pleistocene history which clearly demonstrates the changing climate; each

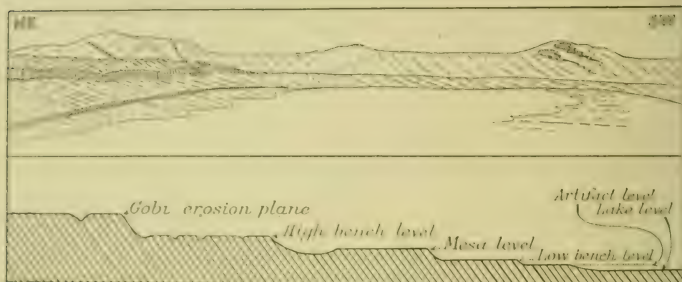


Fig. 6. Sketch of Ungur Tsagan Nor and profile of lake terraces. The upper level is the Gobi erosion plane, a feature probably developed in early Pleistocene time.

lower terrace indicates not only a break in the amount of moisture, but a break which, if the record is interpreted correctly, points to increasing aridity. The lake basins are cut in lacustrine deposits; the lakes of the Pliocene time extended westward to Gur Tung Khara Usu and covered many hundreds of square miles; now they are diminished to playas and are in danger of being buried by the sands.

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